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Incoming:9400850

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

94-RPS-141

MAR 02 1994

Mr. J. McCormick, Director
Air and Toxics Division
U.S. Environmental Protection Agency
Region 10
Mail Stop AT-082
1200 Sixth Avenue
Seattle, Washington 98101

Dear Mr. McCormick:

APPLICATION FOR APPROVAL OF MODIFICATION FOR PLUTONIUM-URANIUM EXTRACTION DEACTIVATION

The enclosed serves as an application for approval of modification (Application) of the Plutonium-Uranium Extraction (PUREX) Plant, in the 200 East Area of the Hanford Site. The Application is submitted pursuant to 40 Code of Federal Regulations 61, "National Emission Standards for Hazardous Air Pollutants."

The purpose of the modification is to deactivate the PUREX Plant. "Deactivation" means to establish a passively safe and environmentally secure configuration for the PUREX Plant at the Hanford Site. Deactivation is expected to take approximately five years to complete. It is further planned to preserve that configuration for a ten or more year period of surveillance. The surveillance period will be used to predict future maintenance requirements.

On the Hanford Site there are a number of facilities that housed various processes associated with the Site's former mission, which will eventually be deactivated, then decontaminated and decommissioned. The PUREX Plant will be the first such major facility to undergo this process since enactment of the 1990 Clean Air Act Amendments. As such, the permitting process established for PUREX deactivation activities will strongly influence the permitting for similar activities at other Hanford Site facilities.

Should you have questions regarding the enclosed, please contact me or Mr. S. D. Stites of my staff on (509) 376-8566.

Sincerely,

James D. Bauer, Program Manager
Office of Environmental Assurance,
Permits, and Policy

EAP:SDS

Enclosure:
Application

cc w/o encl:
D. G. Hamrick, WHC
J. J. LeBaron, WHC
J. J. Luke, WHC

Enclosure

40 CODE OF FEDERAL REGULATIONS 61 APPLICATION FOR APPROVAL OF MODIFICATION FOR PUREX DEACTIVATION

1.0 APPLICANT ADDRESS

U.S. Department of Energy,
Richland Operations Office
P.O. Box 550,
Richland, Washington 99352

2.0 LOCATION OF SOURCE

The location of the PUREX Plant is in the 200 East Area of the Hanford Site, as shown in Figure 2-1. PUREX Plant is at approximate longitude 119° 32 feet (ft) west and latitude 46° 35 ft north on a broad plateau at surface elevation about 700 ft above mean sea level. Figure 2-2 illustrates the facility layout.

3.0 TECHNICAL INFORMATION

The technical information describing the nature, size, design, operating design capacity, method of operation of the source, and emissions control equipment for the PUREX Plant is found in the *State of Washington Department of Health (DOH), Radioactive Air Emissions Permit FF01: Supplemental Information* (DOE 1990). Section 3.1 of this application (below) provides technical information for each proposed deactivation activity, Section 3.2 discusses the source term and emission mechanisms in general, and Section 3.3 provides the estimated emissions and offsite dose to the maximally exposed individual (offsite dose) for each activity and summarizes the total emissions and offsite dose in Table 3-9.

3.1 DEACTIVATION ACTIVITIES

"Deactivation" means to establish a passively safe and environmentally secure configuration, for the PUREX Plant at the Hanford Site. Deactivation is expected to take approximately five years to complete. It is further planned to preserve that configuration for a ten or more year period of surveillance. The surveillance period will be used to predict future maintenance requirements. The ten-year surveillance period represents the typical time duration expected to define, authorize, and initiate follow-on Decontamination and Decommissioning (D&D) Activities.

When fully deactivated, PUREX will be left unoccupied and locked. With the exception of lighting and the consolidated heating, ventilation, and air conditioning (HVAC) system required to maintain the final confinement barrier, there will be no active systems or utilities within the process buildings. The PUREX HVAC confinement system will operate from outside the process building.

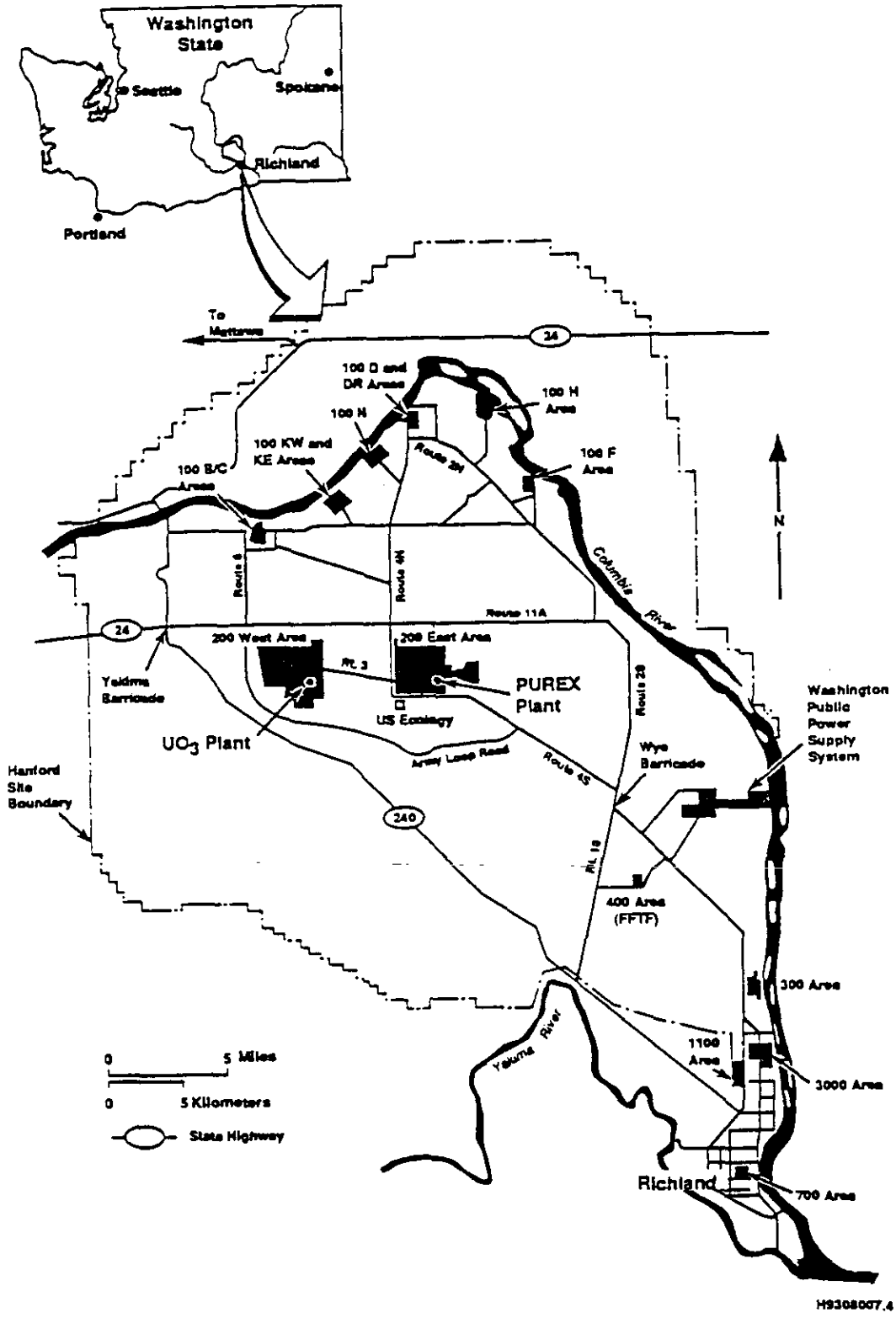


Figure 2-1 Location of PUREX Plant

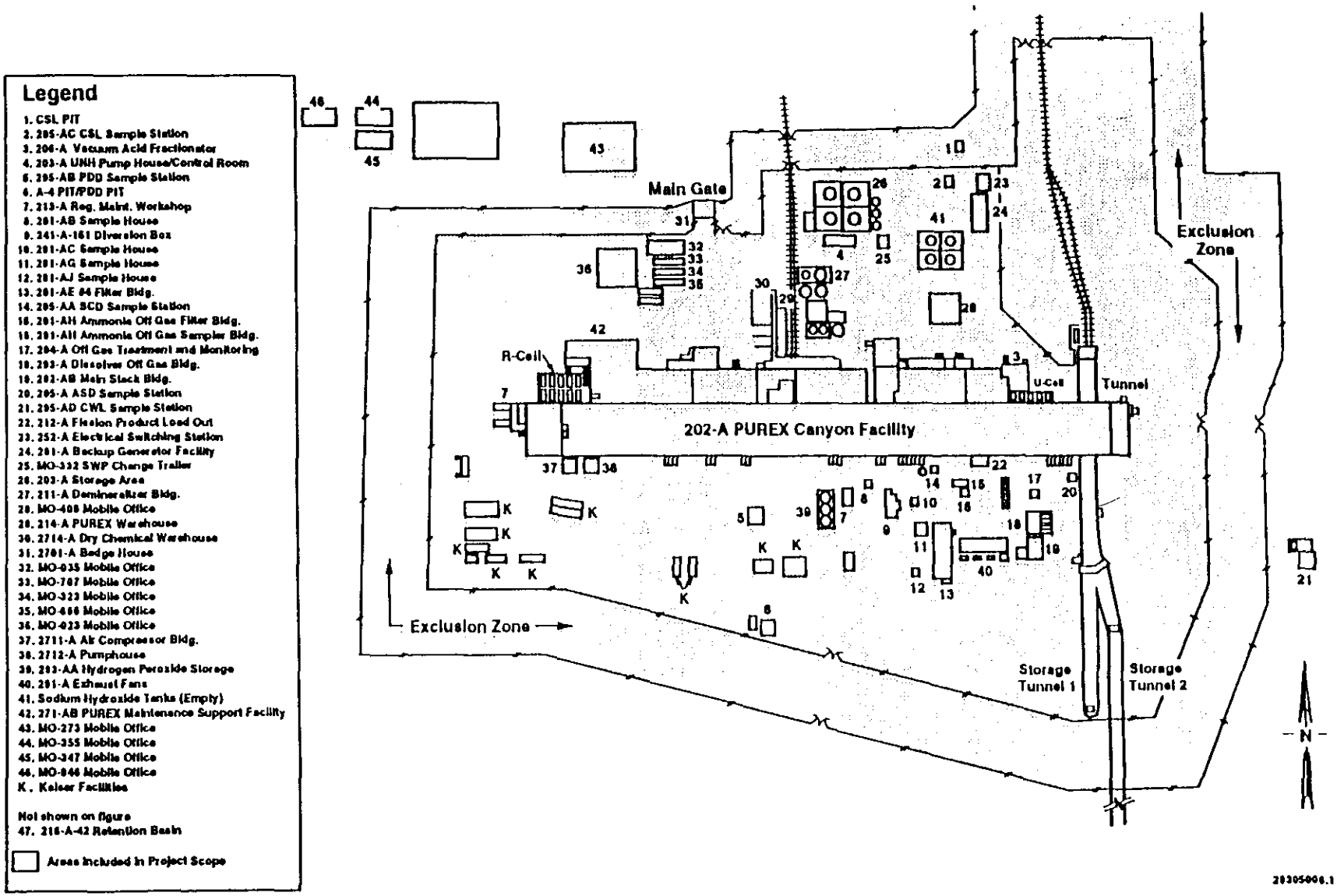


Figure 2-2 PUREX Yard Plan

The proposed deactivation activities for PUREX are limited to those necessary to transition the facility from its current standby state to achieve deactivation objectives. The proposed activities, for the most part, consist of: removal, reduction, and/or stabilization of the remaining radioactive sources; removal of equipment and process liquids; termination of liquid and the consolidation gaseous effluents; shutting off utilities; and removal of the need for personnel entry. Additional activities required for closure, but not included in this work scope, will be accomplished during the final D&D of the facility.

The proposed activities are listed in Table 3-1 and are discussed in greater detail in the following sections. The work descriptions in this application present the preferred alternatives identified for each major deactivation activity. The Appendix to this application contains a spread sheet presenting the data used to calculate the emissions and dose estimates.

Table 3-1 PUREX DEACTIVATION ACTIVITIES	
1	Contaminated Acid Disposal
2	Contaminated Solvent Disposal
3	Single-Pass Reactor Fuel Disposition
4	Slug Basin Deactivation
5	N Reactor Fuel Disposition
6	Chemical Disposition
7	Canyon Flushing
8	In-Plant Waste Concentration
9	N Cell Cleanout
10	Metal Solution Disposition
11	Product Removal Room Deactivation
12	Zirconium Heel Stabilization
13	Sample Gallery Deactivation
14	Q Cell Cleanout
15	Pipe and Operating Gallery and White Room Deactivation
16	Support And Ancillary Systems Deactivation
17	Utilities And Service Systems Deactivation
18	Ventilation Systems Consolidation
19	PUREX Laboratory Deactivation

3.1.1 Contaminated Acid Disposal

Approximately 787,000 L (208,000 gal) of concentrated nitric acid contaminated with uranium, which is currently being held in the 203-A Area uranyl nitrate hexahydrate (UNH) product storage tanks, and in tanks TK-U1 and TK-U2 in the U Cell vault area (Appendix line 26).

Currently the proposed plan for disposal of contaminated concentrated nitric acid is to use existing equipment to destroy the nitric acid via sugar denitration, generally described as follows:

- Denitration of acid in Tanks TK-F15 and/or TK-F16 to a final concentration of about one molar using sugar solution (sucrose) as the denitration agent (Sugar denitration was a routine operation when PUREX was processing fuel)
- Direct atmospheric dispersal of carbon and nitrogen oxides generated as a result of the denitration process
- Possible further concentration of the denitrated solution in the F11 concentrator depending on time and equipment constraints
- Treatment (pH adjustment) of the residual denitrated concentrated solution and subsequent transfer to the underground waste tanks (tank farms). Denitration of the acid solutions before treatment for transfer to the waste tanks reduces the volume of waste transferred by about 33 percent.

The second possible option, which is preferred (however, not available at this time), is for reuse in another nuclear related activity in either the United States or a foreign country. To meet proposed acceptance criteria for use, it may be necessary to distill the nitric acid to reclaim the purified acid and the uranium bottoms. The distillation would be performed using the existing recovered nitric acid fractionator, T-U6, located in U Cell at the PUREX Plant. The fractionator would be operated identically to past operations.

Following the acid disposal activities, the 203-A area tanks, the tanks TK-U1, and TK-U2, piping, and equipment will be flushed and deactivated. Flushing will be used to prevent the tank heels from exhibiting dangerous waste characteristics.

3.1.2 Contaminated Solvent Disposal

Approximately 79,000 L (21,000 gal) of about 25 volume percent tri-butyl phosphate in normal paraffin hydrocarbon (n-dodecane to n-tetradecane) diluent is being stored in Tank 40 in the 211A Area and in one tank trailer, as of January 1994. This solvent was used to perform plutonium and uranium solvent extraction separations during past PUREX processing operations and had been stored in Canyon Tanks G5 and R7, and one tank trailer.

The solvent will either be trucked to a facility where it can be used as a product or, alternately, transferred to a licensed, commercial facility for incineration as waste. Because of the very low levels of radioactive contamination, the solvent will be shipped as low specific activity material in accordance with U.S. Department of Transportation regulations.

The equipment, piping, and cell vessels (G5 and R7) in which the solvent was stored, will be flushed and deactivated.

3.1.3 Single-Pass Reactor Fuel Disposition

This deactivation activity deals with the movement of some very old aluminum clad irradiated fuel from the PUREX slug storage basin. The fuel will be moved to the 105K East Storage Basin.

The slug storage basin at the east end of the PUREX canyon contains four buckets of single-pass reactor (SPR) fuel. The fuel has been stored in the basin since 1971. The SPR fuel consists of 20-cm (8-in.)-long by approximately 3.3-cm (1.3-in.)-diameter uranium cylinders enclosed in aluminum jackets. The fuel contains 2.87 metric tons of highly depleted uranium (0.27 wt percent U-235) in 779 fuel elements. The fuel contains 8.6 Kg of plutonium, which is 26 wt percent Pu-240. The slug storage buckets are 43 cm (17 in.) square by 52 cm (20.5 in.) tall with a grid of 1.3-cm (1/2-in.)-diameter drain holes in the bottom.

Fuel will be transferred wet into the shipping casks, minimizing contaminated dust that can be stirred up and released during the transfer operation, because the wetted surface holds the particles. The fuel's aluminum cladding is expected to have retained or to have lost its integrity prior to transferring (as opposed to losing its integrity while handling the fuel assemblies); thus, no gaseous radionuclides are expected to be released.

The preferred method for disposing of SPR fuel is to transfer the fuel to the 105-K East Storage Basin. The fuel will be transferred in three-well cask cars and K Basin fuel casks. These are the same casks used to transfer N Reactor fuel from the K Basins to PUREX during past PUREX operations. The transfer will be accomplished with the same rail routes and procedures used during past transfers of fuel from the K Basins to PUREX.

Fuel elements have been shipped from PUREX back to the K Basins as recently as 1989. When PUREX was shut down in December 1988, one dissolver charge of N Reactor fuel was left sitting in the cask cars in the PUREX railroad cut. This fuel was returned to the K Basins in early 1989, when it was determined that the restart of PUREX would be significantly delayed.

3.1.4 Slug Basin Deactivation

As discussed in Section 3.1.3, the PUREX slug storage basin was used to store aluminum clad SPR fuel. Sample analyses of the water contained in the slug basin indicates no significant chemical or radiological residues are present (Table 3-2). There are approximately 200,000 L (53,000 gal) of water in the slug basin.

Table 3-2 Slug Storage Basin Water Sample Results

ANALYSIS	RESULT
Appearance	Clear, <1 percent solids, No organic
pH	8.4
Uranium	2.99 E-03 g/L
Total Alpha	4.1 E-02 micro Ci/L
Total Beta	40 micro Ci/L
Ce/Pr-144	<2.29 E-01 micro Ci/L
Co-60	<9.32 E-03 micro Ci/L
Nb-95	<7.1 E-03 micro Ci/L
Ru-103	<3.86 E-02 micro Ci/L
Ru/Rh-106	<4.17 E-01 micro Ci/L
Zr-95	<1.25 E-02 micro Ci/L
Cs-134	1.69 E-02 micro Ci/L
Cs-137	16.4 micro Ci/L
Th-228	2.0 micro Ci/L
Over the Top Dose Rate (4 oz. sample)	<0.5 millirad/hour
Plutonium	4.0 E-07 g/L *

* Based on conversion of the Total Alpha analysis only.

Worker access to the slug basin is limited; thus, remote methods will be used to empty, flush, and stabilize any residual contaminants within the slug basin. The remote methods will require the fabrication of access equipment and implementation of special safety procedures.

The plan for lay-up of the PUREX slug storage basin consists of the following key elements:

- All aluminum clad fuel currently stored in the basin will be removed
- The water will be drained and the walls and floor flushed with water using a crane operated wand
- The basin surfaces will be surveyed or sample analyses will be taken of the flush water to determine the level of residual contamination and the effectiveness of the flushes. Flushing will continue until an engineering evaluation determines that contamination levels are acceptable for proceeding with application of a fixing agent
- If necessary, any residual contamination will be coated with a fixing agent to prevent the contamination from becoming airborne.

3.1.5 N Reactor Fuel Disposition

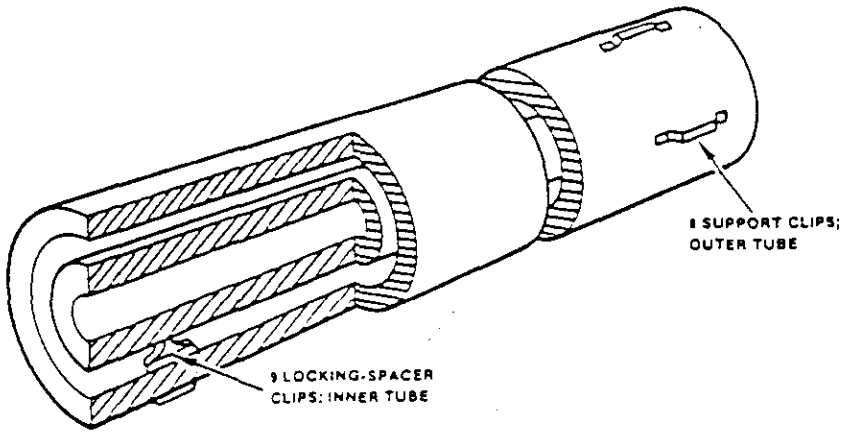
Another deactivation activity will recover spilled fuel from the floors of Dissolver Cells A, B, and C. Fuel from all three cells will be packaged, and shipped to the 105-K West Storage Basin, where it will be stored.

PUREX Dissolver Cells A, B, and C contain zirconium clad N Reactor fuel elements that were inadvertently spilled to the floor during dissolver charging operations. Most of the spilled fuel was retrieved immediately following the spillage. However, because some of the fuel could not be retrieved without removing equipment from the cell, it was left for future retrieval efforts.

Accountability records, although incomplete, indicate that these fuel elements contain 240 kg of 0.95 percent enriched uranium and 17.3 kg of depleted uranium. A review was performed of the available reports and other records regarding fuel spills at PUREX, and an estimate was made of the amount and location of fuel presently on the floors of the dissolver cells. The fuel element components are comprised from pieces that come from the inner and outer section of a fuel assembly (Figure 3-1). The information is summarized in Table 3-3.

Table 3-3 Estimate of Fuel on the PUREX Canyon Floor

Cell	Number of Elements	Uranium (kg)
A	3.5 inners	26
B	22.5 inners, 11.5 outers	230
C	1 inner	4 to 8



	MARK IV				MARK 1-A		
PREIRRADIATION ENRICHMENT OF ^{235}U	0.947% ENRICHED				1.25-0.947% ENRICHED "SPIKE"		
TYPE - LENGTH CODE	E	S	A	C	M	T	F
OUTER LENGTH (IN.)	28.1	24.6	23.2	17.4	20.9	19.6	14.9
DIAMETER OF ELEMENT (IN.)							
1. OUTER OF OUTER ELEMENT	2.42	2.42	2.42	2.42	2.40	2.40	2.40
2. INNER OF OUTER ELEMENT	1.70	1.70	1.70	1.70	1.77	1.77	1.77
3. OUTER OF INNER ELEMENT	1.28	1.28	1.28	1.28	1.25	1.25	1.25
4. INNER OF INNER ELEMENT	0.48	0.48	0.48	0.48	0.44	0.44	0.44
CLADDING WEIGHT (LBS)							
1. OUTER ELEMENT	2.41	2.29	2.18	1.74	1.94	1.83	1.45
2. INNER ELEMENT	1.21	1.15	1.10	0.88	1.18	1.12	0.89
WEIGHT OF URANIUM IN OUTER (LBS)							
1. (0.947% ^{235}U)	35.2	33.1	31.2	23.1			
2. (1.25% ^{235}U)					24.4	22.9	17.3
WEIGHT OF URANIUM IN INNER (LBS) 0.947% U-235	16.5	15.5	14.6	10.9	12.1	11.3	8.6
WEIGHTED AVERAGE OF URANIUM IN ELEMENT (LBS)			50.3			36.1	
RATIO OF ZIRCALOY-2 TO URANIUM (LBS/TON)	140	141.6	143.2	154.1	171.0	172.5	180.7
WEIGHTED AVERAGE (LBS/TON)			140.7			171.3	
% OF PROCESSING LOAD OF EACH TYPE	88	7	1	4	88	10	2
% OF TOTAL ELEMENTS			80			20	
DISPLACEMENT VOLUME GAL/TON URANIUM	16	16	16	16	16	16	16

Figure 3-1 Fuel Assembly

The proposed plan for recovery and disposition of this fuel is to remove the dissolver cell equipment one cell at a time, recover the fuel using a special crane-operated recovery tool, and package the fuel in canisters. The fuel will be transferred to 105-K West Storage Basin using the same equipment and procedures as for SPR fuel. Following retrieval of the fuel, the dissolver cell equipment will be placed back into the cell. If any equipment fails, it will either be stored in a dissolver cell or transferred to the Number 2 PUREX storage tunnel. Jumpers will be replaced when possible, but failed jumpers will be placed in a burial box liner for storage in the PUREX storage tunnel. Section 3.1.12 discusses how the remaining zirconium heels will be stabilized.

3.1.6 Chemical Disposition

PUREX used a wide variety of chemicals to support processing operations (Table 3-4). The chemicals were purchased in bulk quantities and stored in uncontaminated areas such as the 2714A and 275EA chemical warehouses and the 211A chemical tank farm. When processing operations ceased, an inventory of about 1.04 million kg (2.3 million lb) of unneeded chemical products were stored at the plant. A program was initiated to excess the chemicals by resale to the commercial market. The disposition of excess chemicals will continue through the use of the existing surplus sales and chemical exchange programs until it has been determined that there is no reasonable alternative to waste disposal.

Following removal of bulk liquid chemicals from storage tanks, the remaining heels will be characterized for resale potential. Residual heels will be removed as waste or sold as product, as appropriate. The tanks will then be flushed using a commercially available high-pressure spray wand, and the associated piping will be flushed back into the tanks from appropriate termination points in the Aqueous Makeup (AMU) Area. Flushes will be performed until the waste no longer exhibits dangerous waste characteristics (pH between 2 and 12.5).

A certified hazardous waste disposal company will be subcontracted to remove rinsate from the tanks. The tanks will be emptied to the maximum extent possible within existing equipment capabilities. The AMU Area will then be deactivated and isolated from the 211-A Area and other process interfaces, as appropriate. Since these chemicals are not radioactive, there are no radiological emissions associated with the chemical disposition activity.

Table 3-4 PUREX Chemical Inventory

Product	Quantity in kg (lb)
Hydrazine (35 percent)	5,000 (10,300) @ 100KE
Hydroxylamine Nitrate	42,000 (93,000)
Ferrous Sulfamate	43,000 (95,000)
Antifoam	680 (1,500)

Table 3-4 PUREX Chemical Inventory

Product	Quantity in kg (lb)
Sodium Fluoride	140 (300)
Ferric Nitrate	900 (2,000)
Rare Earth Nitrate	1,400 (3,000)
Tartaric Acid	6,000 (12,500)
Sugar	2,000 (5,000)
Mercuric Nitrate	180 (400)
*Total	105,300 (231,800)

*As of January 1, 1994

3.1.7 Canyon Flushing

The purpose of the flushing operation is to remove and minimize the potential for resuspension and migration of radioactive materials and acidic or basic residues from the canyon system. The radionuclides removed will be mostly in the form of dissolved metal nitrate salts. Within the PUREX canyon, treatment, storage, and disposal units operated under Reconstruction Conservation and Recovery Act interim status will be flushed and closed in accordance with the approved closure plan.

Following the completion of the PUREX stabilization campaign in 1990, the process was shut down in accordance with routine operating procedures, which removed much of the special nuclear material (SNM) and fission product waste from the process piping and equipment. Subsequent activities performed in preparation for potential restart of the plant (such as tank calibration and tank integrity assessments) provided additional water flushes of most of the canyon equipment. Therefore, further flushing of the canyon equipment will be limited to that required to ensure that residual heels do not exhibit dangerous waste characteristics (pH between 2 and 12.5) and to remove any suspected high potential "pockets" of SNM or fission products. The residual heels of concern are those that can be found in low areas within the transfer lines, pumps, tanks, and other miscellaneous equipment.

Before flushing activities are initiated, an estimated 189,000 L (50,000 gal) of residual water solution currently held in various canyon vessels will be sent to tank farms. The heels of each canyon vessel will be evaluated to determine the substances of concern, appropriate flush solution, and flushing end point (Table 3-5). The resulting spent flush solution will be transferred to tank farms using routine procedures and existing piping. The liquid level in all vessels will be left at the lowest level possible using existing jets and pumps. (The minimum level is generally between 76 and 379 L [20 and 100 gal].) External surfaces of canyon vessels and the cell walls and floors will be flushed using an appropriate combination of a spray wand, cell washdown nozzles (located about 1.5 m [5 ft] above the canyon floor

Table 3-5 PUREX Process Control Canyon Cell and Equipment Flushing

Process equipment	Flush material	Material removed	End point
Canyon filters	Water	Ammonia Nitrate and Fission Products (FP)	< 1 weight percent ammonia, Engineering Judgement (EJ)
Silver reactors (dissolvers)	None	N/A	N/A
Electric heaters	None	N/A	N/A
Steam heaters	Steam	FP	EJ
Ammonia scrubbers	None*	N/A	N/A
Ammonia scrubber catch tanks	None*	N/A	N/A
Dissolver towers	Water	FP, Nitrates	EJ
Dissolvers	None**	N/A	N/A
Canyon tanks	Water, Chemical	SNM, Nitrates, FP	EJ, pH > 2 and < 12, EJ
Process columns	Water, Chemical	SNM, Nitrates, FP	EJ, pH > 2 and < 12, EJ
Centrifuges	Chemical, Water	FP and SNM solids	EJ
Condensers	Steam or Water	FP and Nitrates	EJ
Acid absorber	Water	Nitrates, FP	pH > 2 and < 12, EJ
Concentrators	Water, Chemical	Nitrates, SNM, FP	pH > 2 and < 12, EJ
Organic contractor tanks (TK-G1 and TK-R1)	Water***	Nitrates	pH > 2 and < 12
Decanter tanks	Water	Nitrates	pH > 2 and < 12
Acid fractionator and support equipment	Water	Nitrates	pH > 2 and < 12
Canyon walls, floors	Water	Nitrates, SNM, FP	pH, EJ

*The ammonia scrubbers and catch tanks were flushed during process equipment integrity testing.

**The dissolvers were flushed or dispositioned during the dissolver heel removal.

***The organic contractor tanks were flushed extensively after the stabilization run to remove solids buildup.

in each cell), and fire fog system nozzles (located above the equipment in each cell). The resulting flush solution will be sampled, and a documented evaluation will be made to determine if further flushing is required. The spent flush solution from this operation also will be transferred to tank farms.

Following the completion of all canyon systems flushing, existing routes to effluent discharge points and to tank farms will be isolated to prevent any possibility of solution flowing back into the canyon.

An estimated 1.9 million L (500,000 gal) of flush solution may be generated during PUREX flushing activities, in addition to the 189,000 L (50,000 gal) of residual water solution previously transferred to tank farms. This estimate is based on past experience using conventional methods (i.e., all solution is disposed of to tank farms directly with no volume reduction at PUREX). Significant waste volume reductions may be achieved by cascading flushes and by using an in-plant evaporator to concentrate the waste and exhaust the water vapors out the main PUREX canyon stack before transfer to tank farms (section 3.1.8).

3.1.8 In-Plant Waste Concentration

As discussed in the Section 3.1.7, approximately 1.9 million L (500,000 gal) of flush solution will be generated during the deactivation of PUREX. Approximately an additional 757,000 L (200,000 gal) of solution is currently being held in various canyon and noncanyon vessels at the facility (Table 3-6). The volume of waste transferred to tank farms can be minimized by performing in-plant concentration using a concentrator formerly used during processing operations (Table 3-6).

Former process evaporator E-F11 has been selected as a candidate to perform in-plant concentration. The E-F11 evaporator could be operated in one of two modes as follows.

- E-F11 could be operated in its normal configuration (Figure 3-3) to boil spent flush solutions, condense the resulting water vapor in the overhead offgas, and recycle the water to perform additional flushing. Although this mode of operation will significantly reduce the amount of waste transferred to tank farms, it generates significantly more waste condensate and cooling water, which would be disposed of to the B, than it saves in space at tank farms.

- The preferred mode for operating E-F11 is to modify the configuration of the evaporator to allow uncondensed water vapor from the offgas to be discharged into the canyon air stream and out the 291-A-1 Stack (Figure 3-2). Controlled evaporation, limited to 3.8 to 22.7 L (1 to 6 gal) per minute, significantly reduces the waste water volume without oversaturating the canyon air. The concentrated waste in the evaporator bottoms will be transferred to Tank F18, treated to meet tank farms acceptance criteria, and transferred to tank farms. A procedure has been written and approved to initiate proof of principle testing using uncontaminated water as the test solution. The equipment and piping modifications necessary to operate in this regime are minor.

Table 3-6 Forecasted Potential Liquid Volumes for Deactivation

Location	Composition	Current volume L (gal) (approx)	Volume if sent directly to tank farms L (gal)	Volume going to tank farms after in-plant concentration L (gal)
Flush solution (canyon vessels)	Nitric acid (1-3M) contaminated with fission products, uranium, and traces of plutonium	1.89 million (500,000) Volume expected for plant flushing	2.08 million (550,000)	94,635 (25,000)
Canyon vessels (various)	Nitric acid (pH 0-3) from tank heels and equipment operability testing	189,270 (50,000)	208,197 (55,000)	49,210 (13,000)
Tank P1	Nitric acid (pH 3-6) from UNH loadout area (203A) sumps and rainwater	363,398 (96,000)	363,398 (96,000)	94,635 (25,000)
Slug storage basin	Fuel storage water contaminated with fission products	200,626 (53,000)	200,626 (53,000)	37,854 (10,000)
Total		2.65 million (699,000)	2.85 million (754,000)	276,334 (73,000)

Operation of the E-F11 evaporator is not required for deactivation, but is primarily an option for waste minimization. 5.7 million L (1.5 million gal) of tank space have been reserved in tank farms for PUREX deactivation activities. However, use of the 5.7 million L (1.5 million gal) of space is contingent upon restart of the 242-A waste evaporator and is further restricted by an 87,000 L (23,000 gal) per month limit on waste transfers. Because PUREX deactivation activities may exceed the 87,000 L (23,000 gal) waste transfer limit in a given month without exceeding the total allowed volume, operation of E-F11 provides an opportunity to maintain transfer operations to tank farms during peak waste generation periods.

As discussed earlier, the sources of radionuclides for the flush water are the contaminated particulates residing on various surfaces within the plant. The radionuclide concentration in the flush water evaporator feed will be relatively low.

3.1.9 N Cell Cleanout

The Plutonium Oxide Production Facility, better known as N Cell, was designed to convert plutonium nitrate solution to plutonium dioxide powder (PuO_2). This area of the PUREX Plant contains a significant portion of the special nuclear material (i.e., plutonium) which still remains at Purex. Most of the readily accessible plutonium, which was present in N Cell has already been removed and sent to the Plutonium Finishing Plant. The amount of plutonium inventory remaining may be as high as 10 kg. Normal N Cell plutonium inventory was about 100 Kg, and the 1988 Calendar Year throughput was approximately 1,200 Kg. (1988 was the last year of normal source operation). The current plutonium inventory is less than .01 of what was processed in 1988.

The process for converting plutonium nitrate to oxide powder was executed in 12 separate gloveboxes. A typical glovebox is shown in Figure 3-4. The gloveboxes contain the equipment and piping necessary for the plutonium oxide conversion process.

The purpose of N Cell cleanout is to remove the SNM (plutonium) from the gloveboxes and to decontaminate the processing area (including the gloveboxes) to achieve a safe configuration for future D&D Activities. Although the accessible plutonium has been removed from the facility by recovering loose powder and equipment flushing, nondestructive assay (NDA) of the plutonium inventory indicates that up to 10 kg of plutonium may still remain (a "most likely" quantity of 3 kg was also estimated).

To ensure that the plutonium inventory in N Cell is reduced such that it does not present a significant hazard during the long-term surveillance phase between deactivation and D&D, the following approach is recommended for the cleanout of N Cell.

Phase 1: During this phase all of the equipment and piping that can be removed through existing gloveports will be removed.

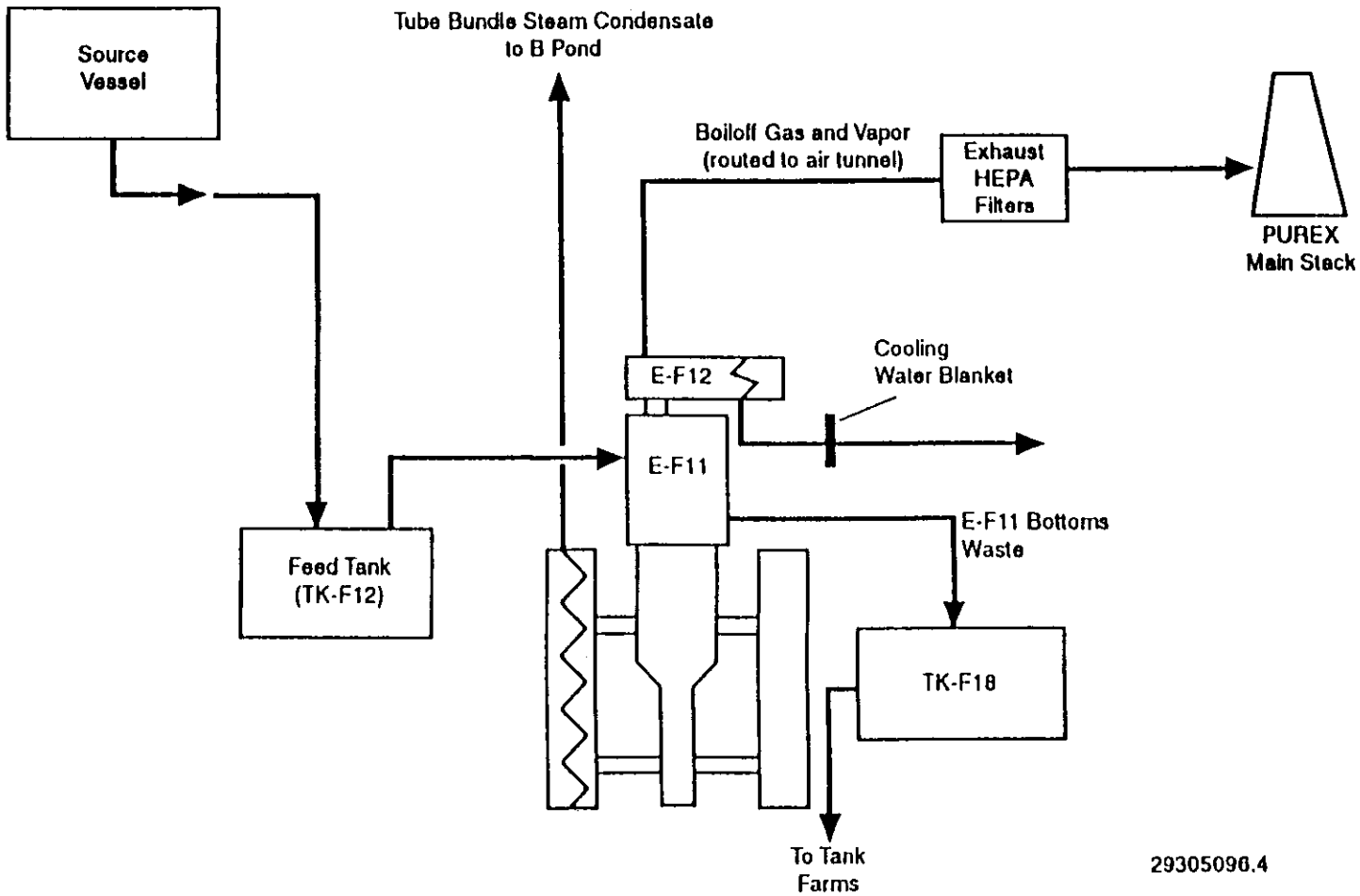


Figure 3-2. In-Plant Waste Evaporator (Vapor Distillate Option).

In-Plant Waste Evaporator (Recycle Option)

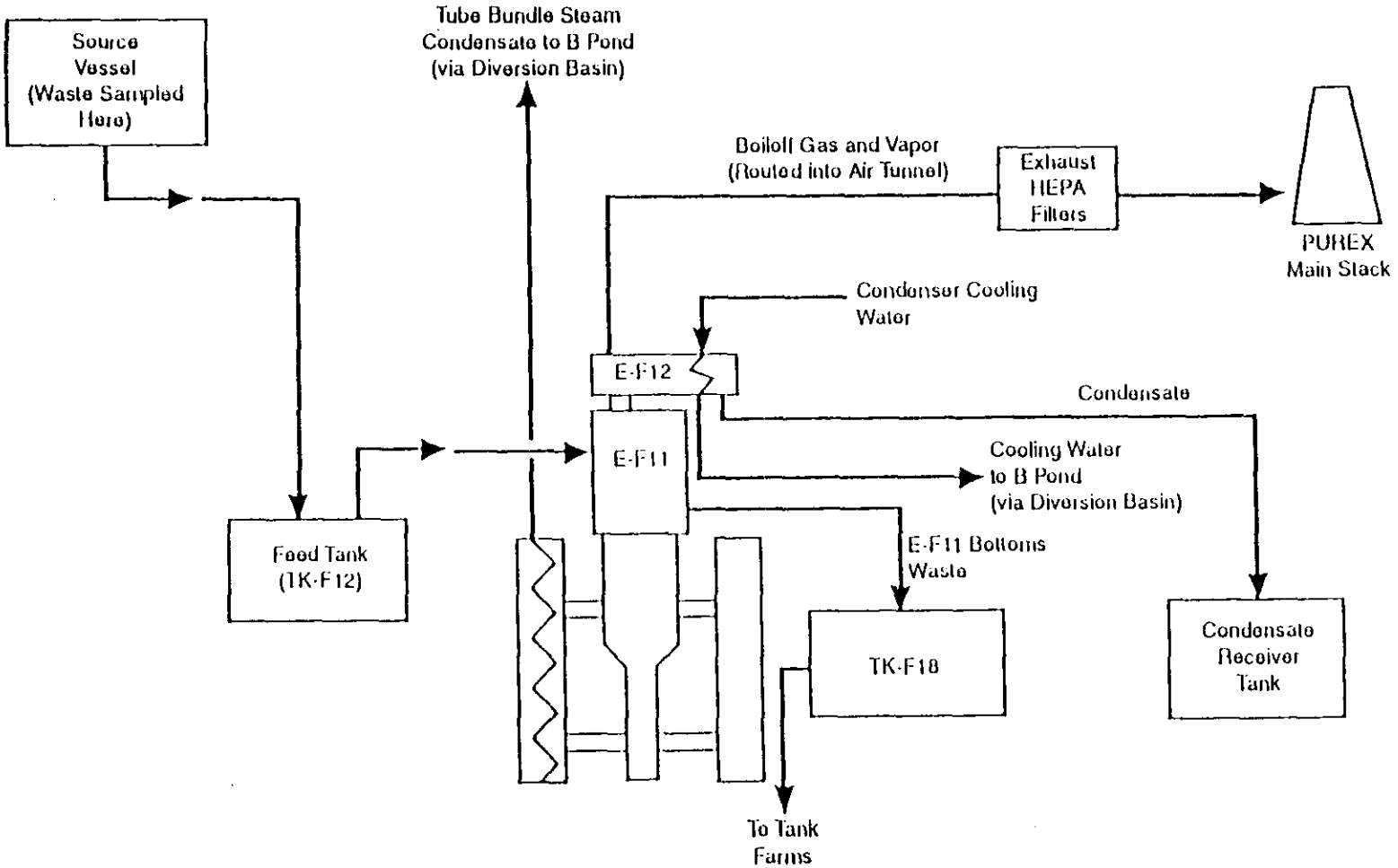


Figure 3-3. In-Plant Waste Evaporator (Recycle Option)

This equipment and piping will not require any unique size reduction and will be packaged as transuranic (TRU) waste and transferred to the Hanford Site TRU waste storage facility. This phase will be performed using procedures and practices common to equipment replacement activities during past N Cell operations.

Phase 2: This phase involves size reduction and removal of any equipment that was too large to remove intact during Phase 1. Special procedures will be developed and equipment procured to perform size reduction of appropriate equipment. The equipment pieces will be removed and handled as TRU waste. An NDA will be performed at the conclusion of Phase 2. It is estimated that Phases 1 and 2 will generate approximately 17.5 m^3 (618 ft^3) of TRU waste.

3.1.10 Metal Solution Disposition

PUREX currently has approximately 20,000 L (5,300 gal) of rework quality metal solution, which was recovered from transition-to-standby cleanout activities and is stored in canyon Tanks D5 and E6. A rework quality solution is the quality of solution that lies outside product specifications and is designated to be reprocessed. The solutions contained in Tanks D5 and E6 consist of plutonium and uranium dissolved in one molar nitric acid, which contains 1-4 g/L of cadmium. (Cadmium nitrate is used as a neutron poison when transferring plutonium rework solution from N Cell.) About 9 kg of plutonium, 5.3 metric tons of uranium, and trace quantities of fission products are contained in the solutions.

The first option is to mix the metal solution with plant flush solution and transfer the contents to tank farms. Direct disposal of this material to tank farms would require that about 958,000 L (253,000 gal) of waste be generated, because of the treatment required to meet the tank farm acceptance criteria.

A second option exists which involves precipitating the uranium, plutonium, and cadmium by adding sodium hydroxide to the solution. The precipitated solids would be drummed and treated as TRU waste.

The uranium, plutonium, and cadmium is precipitated into 208 L (55 gal) drums using sodium hydroxide (Figure 3-5). It has been calculated that the heat of neutralization would cause a temperature rise of only about 14° C in the solution. The precipitated solids would be separated from any remaining supernate, and the supernate would be treated and transferred to tank farms (up to 26,500 L [7,000 gal] of supernate waste would be generated). An appropriate absorbent material would be added to the precipitated solids in the drums to ensure there are no free liquids remaining (150 to 300 drums of TRU waste would be generated). The drums would be packaged and handled in accordance with the requirements for TRU waste to meet Waste Isolation Pilot Plant acceptance criteria and then transferred to the TRU waste storage facility.

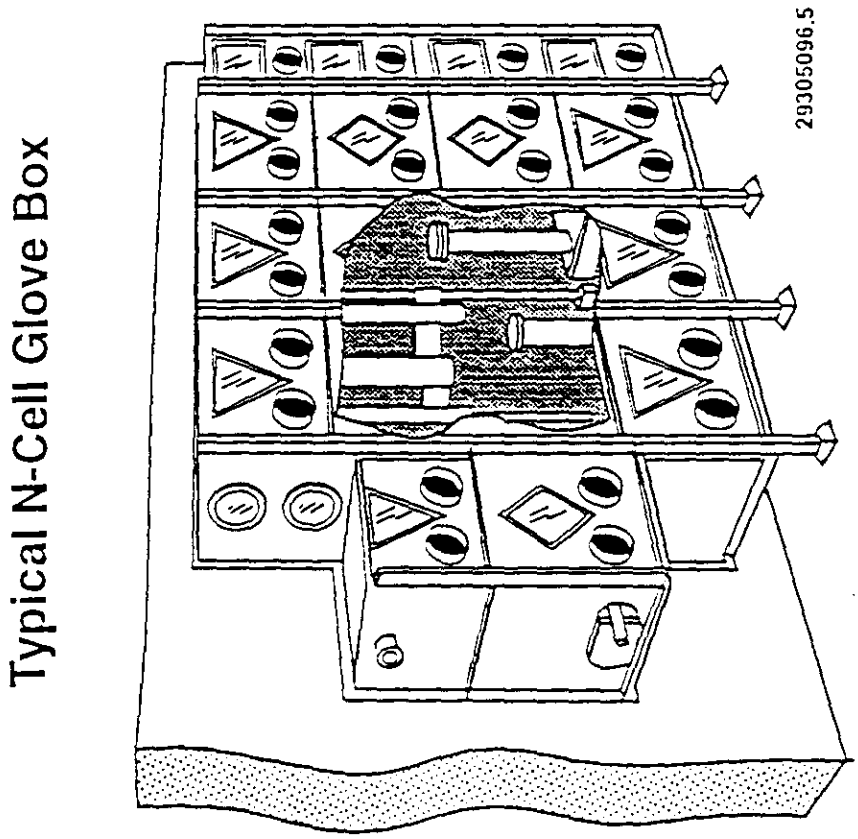


Figure 3-4. Typical N Cell Glove Box.

3.1.11 Product Removal Room Deactivation

The product removal (PR) room was previously used to load out plutonium nitrate solution from the PUREX process into containers (PR cans) for shipment to the Plutonium Finishing Plant (PFP). The PR room was also used to transfer plutonium nitrate solution from the PUREX process to N Cell and to receive rework and waste solutions from N Cell for transfer back to the PUREX process.

The PR room consists of four gloveboxes that contain plutonium nitrate loadout and transfer equipment and the associated piping. During transition-to-standby activities, the PR room tanks and gloveboxes were flushed to remove any gross plutonium inventory; thus, the residual plutonium activity inventory is extremely small. Any material which was loose and prone to air entrainment was removed by washing with water. These internal system flushes were performed with the criteria that the ending plutonium concentration was less than 5 g/L using a total flush volume of about 380 L (100 gal).

The purpose of the PR room deactivation is to further reduce the residual plutonium inventory for the surveillance period between PUREX facility deactivation and the initiation of D&D. The following approach is recommended for PR room deactivation:

Phase 1: Remove small equipment that can be bagged out of the gloveboxes.

Phase 2: As determined to be appropriate based on engineering judgement, remove large equipment requiring size reduction, decontaminate the gloveboxes and apply a contamination fixing agent.

All waste removed from the PR room area will be packaged, handled, transported, and stored as TRU waste in accordance with applicable requirements.

3.1.12 Zirconium Heel Stabilization

The three PUREX dissolvers currently contain pieces of zirconium from past fuel decladding operations. This activity involves the treatment of zirconium cladding fragments with strong caustic solution to ensure that the metal surfaces are passivated with an oxide layer to eliminate the possibility of accidental pyrophoric ignition. The zirconium and any remaining uranium metal is believed to be presently oxidized, but this measure is being taken to provide additional assurance that a metal fire in the dissolver vessels will not occur.

There is a possibility based on preliminary characterization data that some fuel pieces may be present in the dissolvers. The quantity of any residual fuel has not been determined but is estimated to be a maximum of 3,000 Kg of uranium. If fuel is determined to be present, it will be removed and packaged for storage at the K-Basins or left in the dissolvers as appropriate.

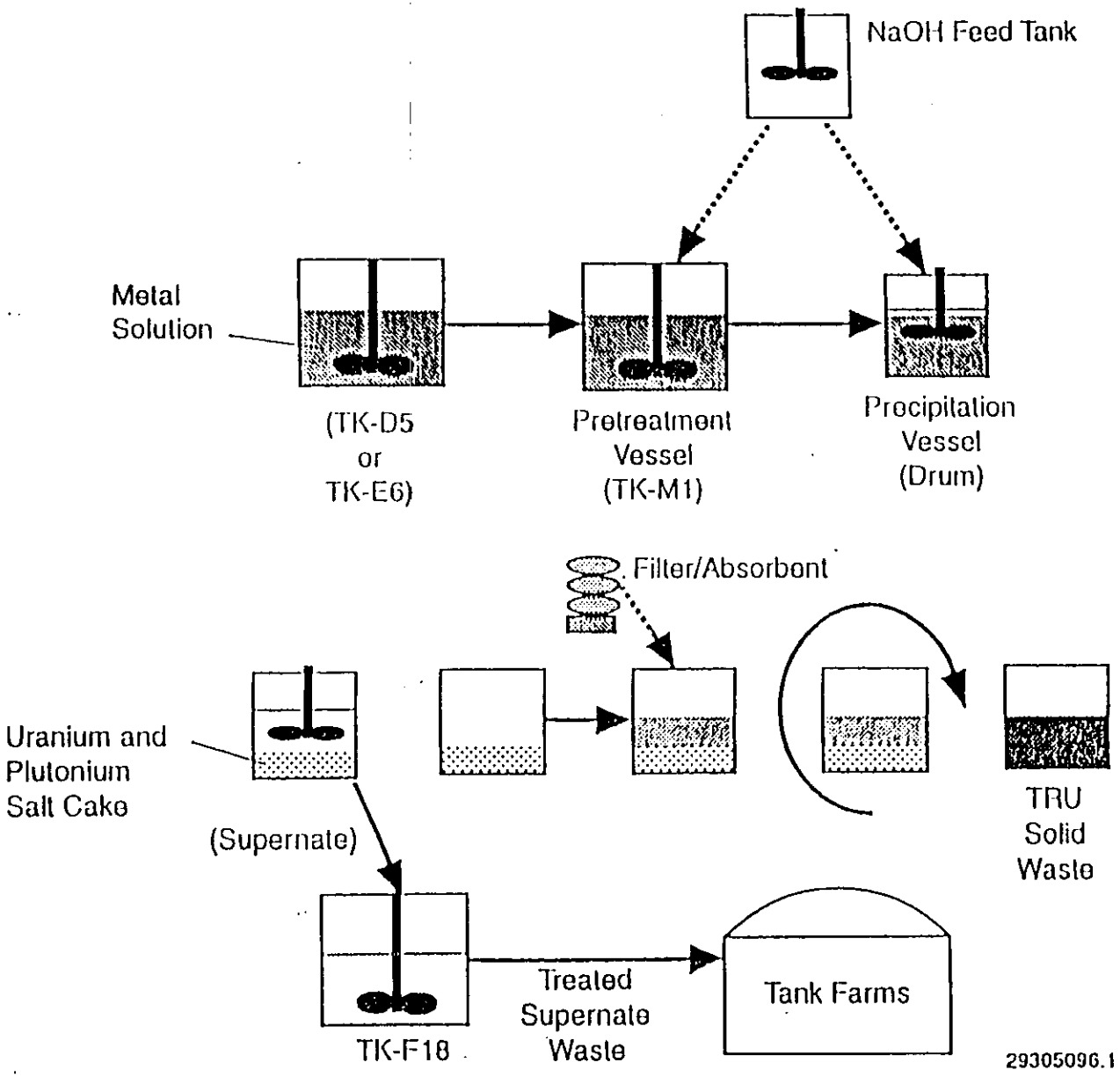


Figure 3-5. Co-Precipitation Flow Diagram

3.1.13 Sample Gallery Deactivation

The sample gallery contains equipment for taking solution samples from canyon vessels. The sample gallery hoods, equipment, and piping contain various levels of radioactive contamination. The ventilation ductwork servicing the sample gallery is also contaminated and has been a source of past contamination spreads in the sample gallery. Therefore, the proposed plan for deactivation of the sample gallery systems is as follows.

- Flush piping and decontaminate or fix contamination in the hoods to minimize the potential for resuspension of contaminants. All piping systems will be drained to eliminate the potential for future leaks
- Remove sample hoods that were used to handle concentrated SNM solutions if they cannot be decontaminated or contamination fixed to within acceptable limits
- Remove the sample gallery ventilation ductwork. The ductwork will not be replaced, because the ventilation system will be realigned in accordance with the plans for ventilation consolidation, as discussed later in this application
- Discontinue services and utilities to the sample gallery.

3.1.14 Q Cell Cleanout

Q Cell was used to perform the final processing required for neptunium purification and shipment during past PUREX operations. Q Cell is located in the storage gallery of PUREX near the PR room and N Cell processing areas. Q Cell was operated between 1958 and 1972, when it was flushed out and shut down. Radiological surveys conducted in the Q Cell processing areas indicate that there are still areas that are contaminated with neptunium. Some beta contamination exists in the form of protactinium (Pa-233), which is a neptunium decay product.

The primary objective for the Q Cell cleanout activities is to remove as much of the residual contamination as possible and practicable. The following approach, similar to that used for N Cell and PR room deactivation, will be implemented.

- Remove the maintenance glovebox equipment and package as TRU waste, as appropriate
- Decontaminate the residual contamination on the glovebox surfaces and apply a fixing agent, as appropriate.

3.1.15 Pipe and Operating Gallery and White Room Deactivation

The pipe and operating gallery (P&O Gallery) provides space for the electrical switchgear, instrument racks, nonradioactive piping, and associated gang valves, which serve the canyon equipment. A few batch chemical addition tanks are also located in this gallery. Shortly after PUREX startup in 1956, the west end of the gallery was contaminated with plutonium nitrate solution.

Because the contamination could not be cleaned up entirely, the remaining contamination was fixed, the room was painted white, and a ventilation barrier was erected to separate it from the rest of the P&O Gallery. This area is now referred to as the white room.

The proposed plan for the deactivation of the P&O Gallery/white room areas is to flush and drain all piping headers, flush and drain or remove tanks and apply a fixative to the white room floor. This fixing agent will require less long-term maintenance than paint in providing an effective barrier to migration of contamination. The electrical switchgear and instrumentation will be de-energized and left in place.

3.1.16 Support and Ancillary Systems

A number of ancillary buildings that provided a variety of support services are located within the PUREX facility complex. The facilities and associated systems of concern include, but are not limited to, the 293-A, 203-A, 211-A, 206-A, 205-A, 212-A, and 294-A Buildings, as well as the various gaseous and liquid effluent sampling and monitoring stations. The PUREX 291-A-1 Stack (main stack) Monitoring Building (292-AB) will not be completely deactivated, because some level of main stack sampling and monitoring is anticipated following PUREX deactivation.

The proposed plan for deactivating these facilities will consist of an appropriate combination of the following tasks.

- Vessels and piping will be flushed, drained, and isolated from canyon interfaces
- Motor driven equipment and electrical equipment will be disconnected and zero energy checks will be performed. Instrumentation will be shut down
- Surfaces will be decontaminated by hand wiping and/or water flushing; concrete surfaces may be chipped or spalled to remove radiological and chemical contaminants. Concrete surfaces may be sealed or painted
- Safety showers and eye wash stations will be drained and isolated
- All emergency response equipment, tools, and supplies will be removed
- Weatherproofing will be performed, and building penetrations will be sealed to prevent intrusion by pests
- The facilities will be locked to prevent entry except as required for surveillance.

3.1.17 Utilities And Service Systems

The plan for terminating and modifying the PUREX facility's utilities and services consists of the following primary elements.

- The water mains will be blanked as far upstream from the PUREX facility as possible without disrupting service to other users. Much of the existing water piping is very old and ruptures occasionally occur. Therefore, blanking the water main will minimize the chance of water intrusion into the facility in case of a line failure. The branch lines will be drained to the extent practical. The sanitary water high tank will be drained and isolated

- The main steam header to the facility also will be blanked as far upstream from the facility as possible. This action will prevent condensation from steam leaks from accumulating in tanks and sumps, thereby eliminating a potential source of liquid waste

- The electrical distribution systems will be consolidated into one location, and systems will be shut down that feed inactive loads. Electrical distribution will be limited to that required for the remote monitoring system, ventilation equipment, and lighting. The three existing backup diesel generators will be maintained and used as backup power for the canyon ventilation fans. The underground fuel tank associated with the diesel generators will be moved above grade within appropriate containment to comply with regulatory requirements

- The current 202-A Building fire suppression systems will be deactivated and drained. Fire protection for the 292-AB main stack monitoring building will be maintained. A dry chemical-type fire suppression system may need to be installed in the area housing the active electrical switchgear

- An electronic system will be installed to monitor the following key parameters:

  - Main stack sampling and monitoring equipment status such as flow rates, high radiation alarms, and fire protection equipment status

  - Electrical power distribution monitoring such as incoming power and emergency power status

  - Ventilation equipment monitoring consisting of monitoring the status of the canyon ventilation fans, such as motor current, motor winding temperature, bearing temperature, and an alert for fan transfer

  - Ventilation system monitoring consisting of zone differential pressures, exhaust filter differential pressures, air dew point, and temperature

  The monitoring system will have the capability to communicate with monitoring stations outside the PUREX facility boundary.

- The compressed air systems will be shut down and deactivated. Active ventilation system equipment (fan and duct dampers) that is dependent upon compressed air for operation will be converted to electric control.

3.1.18 Ventilation Systems Consolidation

The ventilation system in the 202-A Building is designed and operated to keep normal work areas free of radioactive contamination by maintaining air flow from zones with little potential for contamination into zones of progressively greater contamination potential. The ventilation air is handled through four systems: canyon (System 1), sample gallery (System 2), service area (System 3), and laboratory (System 4). Control is provided by maintaining minimum differential pressures between the ventilation zones.

The current operation of the PUREX ventilation system requires a discharge of about 170,000 cubic feet per minute (cfm) through 10 of the registered 11 registered ventilation stacks at any given time. (Stacks 296-A-5A and 296-A-5B do not operate simultaneously). Approximately 80,000 cfm of the 170,000 cfm is discharged via the canyon exhaust system. Three electric motor driven canyon exhaust fans are available to maintain the necessary ventilation requirements. (A steam driven fan is available as a backup). The remaining 90,000 cfm of exhaust air is discharged via various exhaust fans and stacks located throughout the facility.

Consolidation of the ventilation systems is recommended to reduce the volume of air discharged and the number of stack monitoring stations that must remain active following PUREX deactivation. The proposed plan is to cascade air from one ventilation system to another with eventual discharge of all air through the canyon and main stack. This ventilation configuration will allow shutdown and deactivation of all stacks except the main stack and will reduce the total airflow discharged to about 40,000 to 60,000 cfm, and will allow possible isolation of the deep bed fiberglass filters from the final exhaust train. Isolation of the deep bed filters is desirable, because the filters may contain a large inventory of residual radionuclides from past operations. The current and cascade ventilation concepts are shown in Figures 3-6 and 3-7 respectively.

Figure 3-6: SIMPLIFIED EXISTING PUREX HVAC

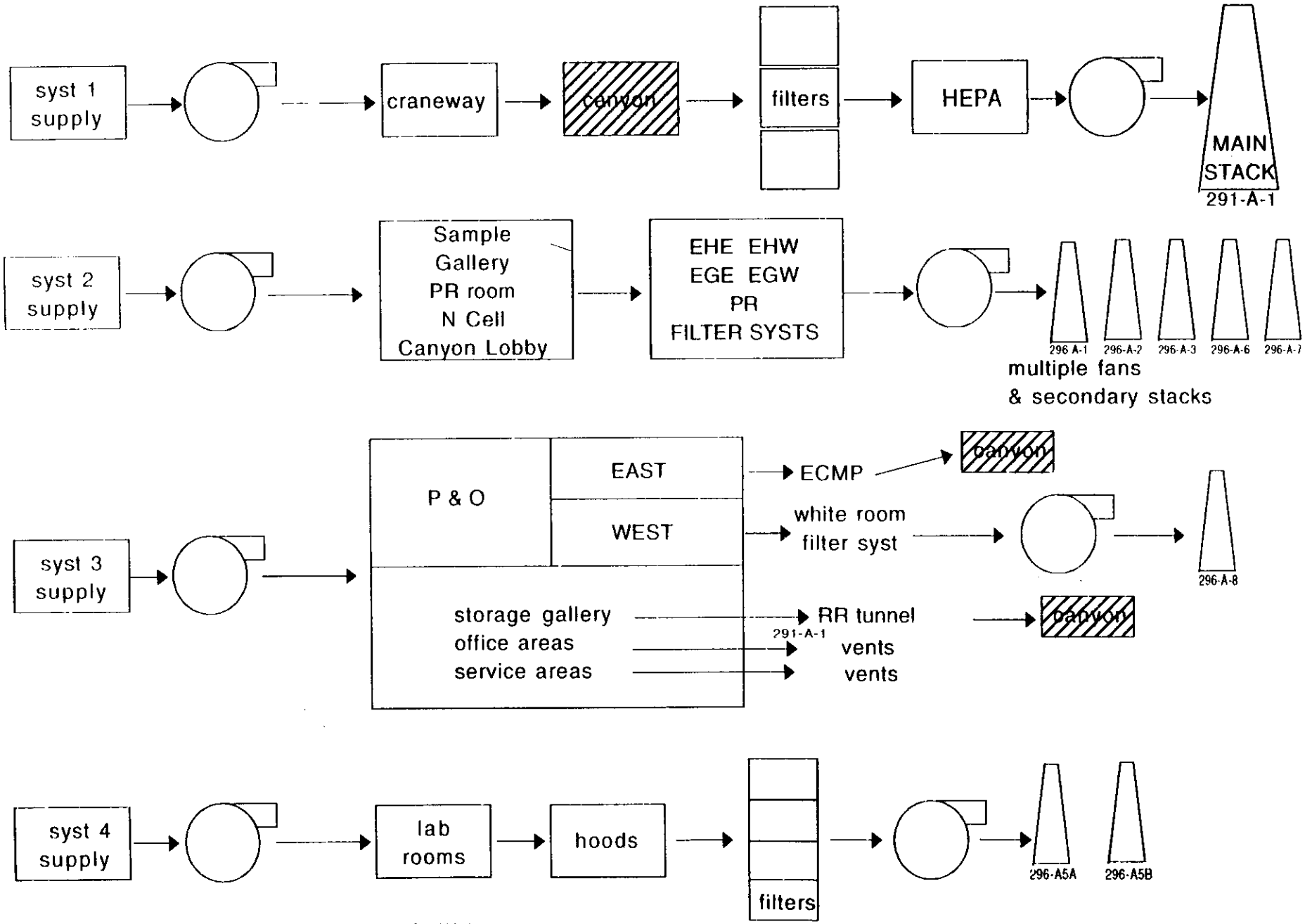
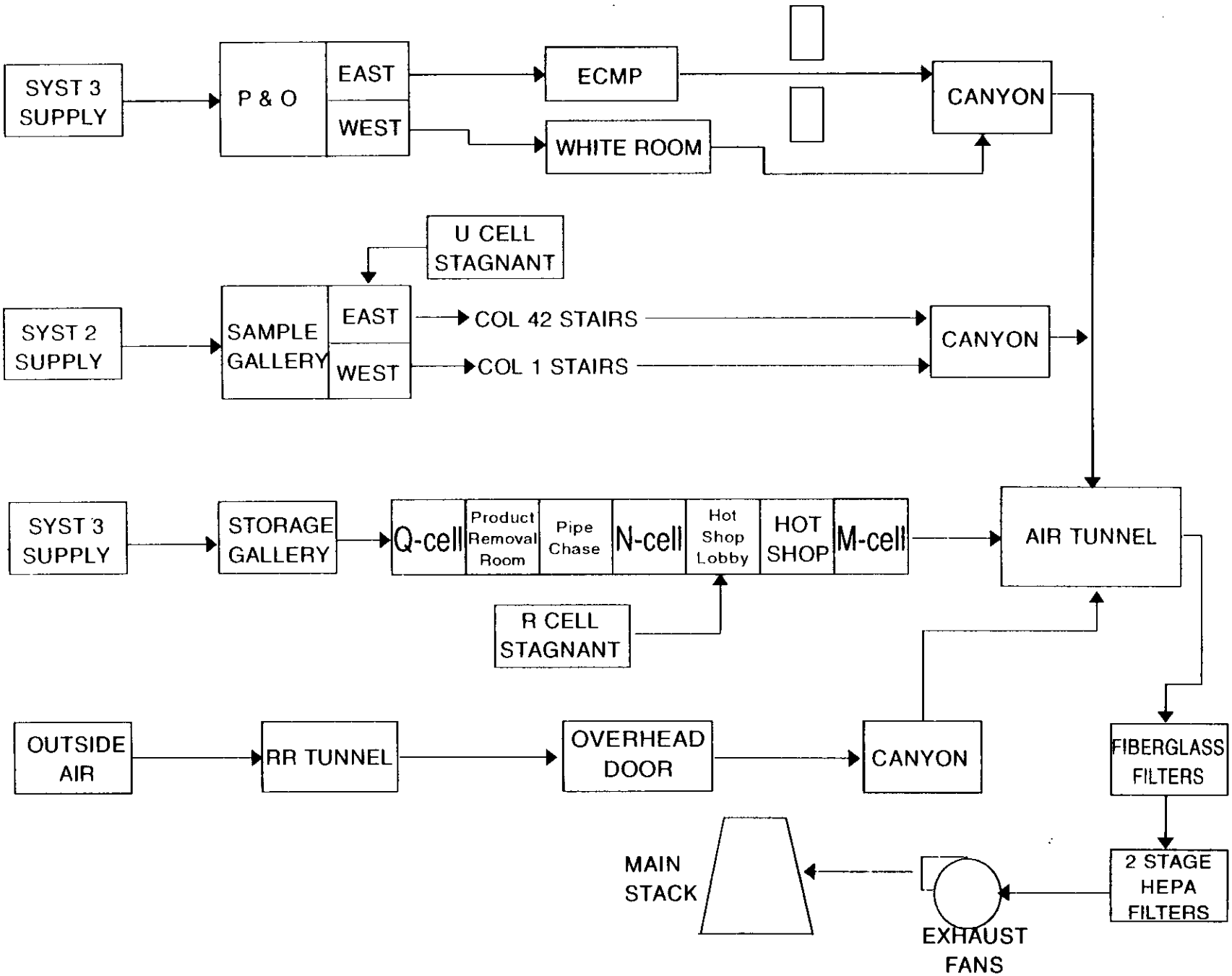


Figure 3-7: SIMPLIFIED REVISED HVAC FLOW SCHEME



On-line equipment will be reduced by using a lower air flow with only one of the three canyon exhaust fans operating (the other two will be maintained as backups with the steam backup deactivated) and the supply fans off. To simplify equipment needs, the supply ducting will be used with induced draft. Most of the existing parallel ventilation flow paths will be eliminated by redirecting the air flow through three pressure zones including the P&O Gallery, the Sample Gallery, and the 673 feet elevation basement zones (Storage Gallery, Cells Q, M, and N, Product Removal Room, and Hot Shop). The Laboratory, Sample Gallery, and lower (673 foot elevation) building processing areas will be cleaned and decontaminated to a level that will reduce contamination problems.

Air will enter the P&O Gallery at the center by induced draft via the supply headers. Flow will be from the P&O center to the ends, where it will exit to the Canyon via the East Crane Maintenance Platform (east) and the White Room (west). Likewise, air flow will enter the sample gallery at the midpoint and will flow to the ends, where it will be redirected to the Canyon via existing stairwells. Ventilation of the 673 feet elevation zones will be accomplished by introducing air into the Storage Gallery that will flow toward the west end of the building and into the air tunnel openings located in M Cell. Air will flow in series through Q Cell, Product Removal Room Column 5 chase, N Cell, Hot Shop and M Cell. As described above, the proposed activities for the HVAC modification involve the use of existing air flow pathways wherever possible. To ensure adequate airflow, additional air ducts will be required. Any supply and discharge pathways that are no longer needed will be blanked and sealed.

The modification activities necessary to implement the cascade flow concept are the same as those used in the past for PUREX modifications and upgrades. Some of the ducting involved in this modification is contaminated. The levels of contamination have not been determined and cannot be quantified unless several penetrations are made at various duct locations. However, releases from the HVAC modification activities would not be expected to be any greater than for releases during past facility operations such as installation of the canyon exhaust fourth high efficiency particulate air (HEPA) filter, routine HEPA filter changes, decontamination of the canyon exhaust plenum and associated ducting, routine ventilation flow adjustments, main exhaust stack flushing, construction of the 292-AB main stack sample building and associated monitoring systems, maintenance and repair of fans, dampers and associated controls, etc. Furthermore, certain precautions taken to protect personnel during the modification activities, such as "green house" installation and increased local monitoring, will serve to detect and mitigate any local radionuclide releases.

The final tie-ins and switching of the HVAC system will not occur until all canyon deactivation activities are complete. This will reduce the potential for resuspension of existing radionuclide inventory. As a result, this activity should not result in radionuclide releases that would exceed those for similar activities conducted during past facility operations.

3.1.19 PUREX Laboratory

The PUREX laboratory will continue to be used to support PUREX deactivation activities until the demand for analytical services can be reduced to the extent that other onsite laboratories can be used effectively. The laboratory then will be deactivated by removing all chemical reagents and salvageable analytical equipment, by decontaminating and stabilizing radiologically contaminated areas, and tieing off the ventilation system.

3.2 SOURCE TERM AND EMISSIONS

The source term used to represent potential to emit is comprised of the nuclear fuel and materials stored in the PUREX Plant as well as the contaminated material, which remains from historic PUREX Plant activities. This section contains a general discussion of the source term and the emission generation mechanisms for radionuclides from the proposed PUREX deactivation activities.

Nuclear fuel stored in the PUREX Plant is from; zirconium clad fuel remaining in PUREX dissolver cells since the last routine operation in 1988, and from the aluminum clad N-Reactor fuel, in the slug storage basin, that dates back to 1971. The nuclear fuel, as well as the other materials in the radionuclide inventory, have been decaying and cooling off. The cooling off period has done little since 1988 to change the specific activity of the remaining plutonium and uranium bearing materials; however, it has reduced the activity of some fission product radionuclides of this fuel. Approximately 1.83×10^5 Curies (Ci) represent the total source term currently in the plant (Appendix line 478).

The last year of normal PUREX Plant operation was 1988. For that reason, this application uses the airborne radionuclide emissions generated by the PUREX Plant in 1988, where appropriate, as the conservative emissions estimate of airborne radionuclides to be generated by deactivation activities. (PUREX Plant annual radionuclide releases for the year 1988 were obtained from Coony and Thomas [1989]).

Particulates are the only radionuclides expected to be generated by the proposed deactivation activities. The proposed PUREX deactivation activities consist, for the most part, in the movement of equipment or liquids used during processing, from the canyon, and washing down the canyon and canyon equipment. Such activities may provide the potential for resuspension of radioactive particulates. Liberation of substantial quantities of gas-phase radionuclides (Xe, Kr, I, Rn, C, and CO_2) would only be expected if fuel is chemically changed (dissolution or fire). No such activities are planned for the deactivation of PUREX.

The existing emissions control system (DOE 1990) contains a fiberglass filter and two stages of HEPA filters, which will not be bypassed or compromised during the proposed deactivation activities. Since DOH has determined that the best available radionuclide control technology (BARCT) for particulate radionuclides is HEPA filtration, it is understood that the proposed deactivation activities will use BARCT.

During normal plant operations, as much as 2.4×10^6 Ci of actinides and 13.0×10^6 Ci of fission products (15.4×10^6 Ci total) existed in the PUREX Plant (WHC 1993b). Based on the analysis presented in this application, and using conservative assumptions, approximately 1.83×10^5 Ci currently exist in the plant, or about a factor of 0.01 less than what existed in the plant during peak operation periods.

During normal plant operations, the only radionuclide releases exceeding 1 Curie/year were tritium, carbon-14, and krypton-85. None of these gas-phase radionuclides are expected to be released from PUREX Plant deactivation work. The gas-phase radionuclides are only released from fuel processing operations. The total gas-phase radionuclide release for 1988 was 2.00×10^5 Ci, while the total activity released as particulates was 2.1 Ci. Assuming that the proposed deactivation activities would generate the release of airborne particulate radionuclide releases at a rate proportional to normal plant operation, deactivation activities would provide approximately 0.00001 of the normal plant operation releases. The results of the analysis in this application indicate that approximately 2.84×10^{-5} Ci (Appendix line 479) will be released as a result of deactivation activities.

An estimate of the expected radionuclide emissions has been provided for each task throughout section 3.3. Except for the contaminated solvent, for which actual data are available, the estimates provided were performed using the extremely conservative emission adjustment factors in 40 Code of Federal Regulations (CFR) 61, Appendix D (EPA 1990). Emission adjustment factors used in these calculations for material state and particulate controls are provided in Tables 3-7 and 3-8 respectively. The appendix, to this application, contains the tabulated; data used, calculations used to arrive at the estimated emissions, and offsite dose for each activity (WHC 1991). The emissions control equipment is discussed in DOE 1990.

Table 3-7 Adjustment Factors for Material State
(40 CFR 61, APPENDIX D)

MATERIAL STATE	ADJUSTMENT FACTOR
GASES	1.0
LIQUIDS/PARTICULATES	1×10^{-3}
SOLIDS (NO DUST)	1×10^{-6}
BOILING CONDITIONS OR TEMP > 100 ^{o}C	1.0

Table 3-8 Actual Equipment Adjustment Factor for Particulates

CONTROL FOR PARTICULATES	ADJUSTMENT FACTOR	EFFICIENCY
HEPA FILTER	0.0005	99.95 percent
FIBERGLASS FILTER	0.0010	99.90 percent
F11 CONCENTRATOR	0.0010	99.90 percent

For releases out the main stack (291-A-1), a constant adjustment factor of 2.5×10^{-10} was applied for the fiberglass and two stages of HEPA filters since they are in series (ERDA 1976). For releases out the Product Removal Room Stack (296-A-1) from N Cell, the Product Removal Room and Q Cell, a constant adjustment factor of 2.5×10^{-7} was applied which represents two HEPA filters in series with an individual efficiency of 99.95 percent (ERDA 1976). The F11 concentrator was designed to provide an equivalent adjustment factor of greater than 1×10^{-5}. For this analysis, an adjustment factor of 1×10^{-3} was used for concentrator F11 to ensure a conservative estimate of emissions.

3.3 DEACTIVATION ACTIVITY EMISSIONS

This section hypothesizes worst case non-accident release scenarios for each proposed deactivation action item (WHC 1993a). The release scenarios are those which can reasonably be proposed in each case. Refer to the same titled subsection of section 3.1 for discussion of the activity itself. The Appendix to this application contains the tabulated; data used, calculations used to arrive at the estimated emissions, and offsite dose for each activity (WHC 1991). The offsite dose estimate, derived in the Appendix, is also included for each activity and is summarized in Table 3-9.

3.3.1 Contaminated Acid Disposal

The proposed disposal of contaminated nitric acid uses existing equipment to destroy the nitric acid via the sugar denitration process (section 3.1.1) at a temperature of 95-98 °C. The plan is to denitrate the nitric acid over a 240-320 day period. It should be noted that because the processing of the nitric acid will be conducted over a relatively long period, the radionuclide concentration will be very low. The processing time per 9500 L (2500 gal) batch of 10 M nitric acid is 72 hours.

The radiological contamination present in the nitric acid results from the presence of uranium and trace fission products. The average uranium concentration in the 787,000 L (208,000 gal) of nitric acid (~10 molar) is assumed to be approximately 11 grams/L (each tank has a different concentration ranging from 1.15×10^{-04} to 15 g/L, Appendix line 36). This results in a total activity from the stack of approximately 1.07×10^{-9} Ci, using adjustment factors of 1.0 for the material state (conservative assumption since it will operate at close to boiling conditions) and

2.5×10^{-10} for filtering (Appendix line 26). The offsite dose from this activity is estimated to be 2.55×10^{-9} mrem (Table 3-9).

The second possible disposal option (as discussed in 3.1.1) is to make the contaminated nitric acid available for reuse in another nuclear related activity in either the United States or a foreign country. To meet proposed acceptance criteria, it may be necessary to distill the nitric acid to reclaim the acid from the uranium bottoms. The distillation would be performed using the existing recovered nitric acid fractionator, T-U6, located in 206-A Facility at the PUREX Plant. The fractionator would be operated identically to past operations. Potential radioactive emissions associated with this activity should be no higher than the 1.07×10^{-9} Ci previously estimated. The offsite dose from this activity is assumed to be the same as the proposed option (2.55×10^{-9} mrem), in order to represent the worst case scenario and simplify the total estimate (Table 3-9).

3.3.2 Contaminated Solvent Disposal

Tank 40 does not have a filter installed. As a result, no factor for filtering was applied. Based on actual emissions data, the expected release from this activity is 1.87×10^{-10} Ci (Appendix line 402). The offsite dose from this activity is estimated to be 2.95×10^{-10} mrem (Table 3-9). On January 3, 1994, the U.S. Environmental Protection Agency (EPA), Region 10, provided the guidance that this activity was consistent with routine plant operations and did not meet the definition of "modification" as a "physical or operational change" in 40 CFR 61.15, and thus did not require approval pursuant to 40 CFR 61.96 (EPA 1994).

3.3.3 Single Pass Reactor Fuel Disposition

The aluminum clad fuel contains approximately 2870 Kg of uranium (0.27 wt percent of U-235) and 8.1 Kg of plutonium (26 wt percent of Pu-240). Under the unlikely assumption that none of the aluminum cladding held its integrity, and applying adjustment factors of 1×10^{-3} for particulates and 2.5×10^{-10} filtering, results in a worst case release of 1.47×10^{-8} Ci. A conservative adjustment factor of 1×10^{-3} was used for the material state to compensate for any embrittlement to the nuclear material during irradiation and any subsequent adverse handling effects (Appendix line 88). The offsite dose from this activity is estimated to be 6.88×10^{-9} mrem (Table 3-9).

3.3.4 Slug Basin Deactivation

Since radioactively contaminated dust cannot be easily resuspended from wet surfaces, there is no anticipated radiological release as a result of the flushing activity. After the surface has dried, application of the surface coating will bind any dust, and prevent any release of residual activity from taking place in the future.

If slug basin water is concentrated, prior to sending it to tank farms, the estimated maximum release is 8.14×10^{-13} Ci. This emission estimate was obtained based on concentrating these liquids in concentrator F11 (sections 3.1.8 and 3.3.8), applying adjustment factors of 1.0 for boiling liquids,

1.0×10^{-3} for the concentrator F11 and 2.5×10^{-10} for filtering (Appendix line 131). The offsite dose from this activity is estimated to be 1.96×10^{-14} mrem (Table 3-9).

3.3.5 N-Reactor Fuel Disposition

The proposed recovery operation involves the collection of approximately 300 Kg of uranium. The fuel's zirconium cladding is expected to have retained or already lost its integrity as opposed to losing its integrity while handling the fuel assemblies; thus, no gaseous radionuclides are expected to be released. Applying adjustment factors of 1×10^{-3} for particulates and 2.5×10^{-10} for filtering, results in a potential emission of 2.65×10^{-9} Ci. A conservative adjustment factor of 1×10^{-3} was used for the material state to compensate for any embrittlement to the nuclear material during irradiation and any subsequent adverse handling effects (Appendix line 197). The offsite dose from this activity is estimated to be 3.05×10^{-10} mrem (Table 3-9).

3.3.6 Chemical Disposition

Since these chemicals are not radioactive, there are no radiological emissions associated with the chemical disposition activity.

3.3.7 Canyon Flushing

Assuming that there are currently 189,000 L (50,000 gal) in the canyon tanks, 360,000 L (96,000 gal) in the P tanks and that the 1.9 million L (500,000 gal) of flush water is characteristically similar to the canyon vessel flush water with the highest concentration of radionuclides after flushing, which was tank G2, a total estimated emission of 1.67×10^{-9} Ci was obtained for this activity. This emission estimate was obtained based on concentrating these liquids in concentrator F11, and using adjustment factors of 1.0 for boiling liquids, 1.0×10^{-3} for the concentrator F11 and 2.5×10^{-10} for filtering (Appendix line 263). The offsite dose from this activity is estimated to be 1.33×10^{-10} mrem (Table 3-9).

3.3.8 In-Plant Waste Concentration

While it is presently planned to send the flush water from the canyon flushing operation to tank farms where it would be concentrated by an evaporator, there is also an option to send the flush liquids to PUREX's F11 evaporator for concentration prior to sending the waste to tank farms. This option would send the overheads from the evaporator into the canyon air stream. The operation of F11 has already been assumed in arriving at the estimated radionuclide emissions in Sections 3.3.4 and 3.3.7.

3.3.9 N Cell Cleanout

Estimated emissions associated with 10 Kg of plutonium are expected to be on the order of 1.94×10^{-7} Ci using adjustment factor of 1×10^{-3} for particulates and 2.5×10^{-7} for filtering (Appendix line 414). The offsite dose from this activity is estimated to be 1.85×10^{-6} mrem (Table 3-9).

Stack 296-A-1 services N Cell, Q Cell and the Product Removal Room. Emissions from stack 296-A-1, in calendar year 1988, were 1.81×10^{-6} Ci for alpha emitters and $<1.04 \times 10^{-6}$ Ci for beta emitters which is a total of 2.85×10^{-6} Ci (section 3.2). Even though dust contamination is not expected to exceed these values for the combination of the three areas during deactivation, an additional emissions estimate is conservatively assumed to be equal to the calendar year 1988 emissions data and are included as the stack operating baseline (Appendix line 465). Thus, the estimated baseline offsite dose, from stack 296-A-1, is 1.57×10^{-5} mrem (Table 3-9).

3.3.10 Metal Solution Disposition

Plutonium and uranium metal nitrate solutions, approximately 20,000 L (5,300 gal) stored in canyon tanks D5 and E6 will be disposed of via one of two options (section 3.1.10). Potential radioactive emissions from either option are estimated to be 1.41×10^{-10} Ci using adjustment factors of 1×10^{-3} for liquids and 2.5×10^{-10} for filtering (Appendix line 284). The offsite dose from this activity is estimated to be 1.21×10^{-9} mrem (Table 3-9).

3.3.11 Product Removal Room Deactivation

Since the Product Removal Room gloveboxes and tanks were flushed to remove the gross activity during transition of the plant to standby condition, the residual plutonium activity inventory is estimated to be extremely small. Previous internal system flushes were performed with the criteria that the ending plutonium concentration would be less than 5 grams/L using a total flush volume of approximately 380 L (100 gal). Under the conservative assumption that only half the contamination was removed, a value of 946 g of Pu-239 remaining in equilibrium with 4.26 g of Am-241 (0.45 wt percent of Pu-239) is obtained. This results in an emission value of 1.83×10^{-8} Ci using adjustment factors of 1×10^{-3} for particulates and 2.5×10^{-7} for filtering (Appendix line 427). The offsite dose from this activity is estimated to be 1.75×10^{-7} mrem (Table 3-9). (See also, stack 296-A-1 emissions and dose, section 3.3.9).

3.3.12 Zirconium Heel Stabilization

No release of radionuclides to the air are expected from the passivation of the zirconium cladding fragments of this activity. There is a possibility, based on preliminary characterization data, that some fuel pieces may be present in the dissolvers. The quantity of any residual fuel has not been determined but is estimated to be a maximum of 3,000 Kg of uranium. If fuel is determined to be present it will be removed and packaged for storage at the K-Basins or left in the dissolvers as appropriate. Under the assumption that the uranium to other radionuclide ratios are characteristically similar to

that present in the N-Reactor zirconium fuel elements (12 percent Pu-240, Mark IV, five year old fuel), heel stabilization results in an estimated emission of 2.65×10^{-8} Ci. This estimate is based on using adjustment factors of 1×10^{-3} for liquids and 2.5×10^{-10} for filtering (Appendix line 328). In addition, the offsite dose from this possible activity is estimated to be 3.05×10^{-9} mrem (Table 3-9).

3.3.13 Sample Gallery Deactivation

The Sample Gallery decontamination activities are not expected to result in an emissions increase over the levels of radionuclides released to the atmosphere during normal plant operations. Thus, the estimated emissions are assumed to be the 1988 release of radionuclides from the sample gallery, which was $< 5.22 \times 10^{-7}$ Ci for alpha emitters and $< 1.42 \times 10^{-6}$ for beta emitters, (total of 1.94×10^{-6} Ci) (Appendix line 466). The offsite dose from this activity is estimated to be 4.56×10^{-6} mrem (Table 3-9).

3.3.14 Q Cell Cleanout

Before attempts were made to decontaminate the facility, the facility contained a total of approximately two grams of Neptunium-237 (Schofield 1993). The facility can be expected to contain considerably less activity now. The Protactinium daughter is relatively short-lived, so it will be in equilibrium with the Neptunium-237 parent and present at the same number of Curies as the parent. Neptunium has a specific activity of 7.05×10^{-4} Ci/gram; thus, if two grams of Neptunium-237 are present in Q Cell, the total radionuclide inventory will be 2.82×10^{-3} Ci. Applying adjustment factors of 1×10^{-3} for particulates and 2.5×10^{-7} for filtering results in an estimated release of 7.05×10^{-13} Ci. The offsite dose from this activity is estimated to be 3.06×10^{-12} mrem. The dose factor for Protactinium-233 is included in the dose factor for Neptunium-237; therefore, an isotope offsite dose factor of 0 mrem/Ci was used for Protactinium-233 to avoid double counting (Appendix line 440). (See also, stack 296-A-1 emissions and dose, Section 3.3.9).

3.3.15 Pipe and Operating Gallery/White Room Deactivation

The P&O Gallery is free of radioactive contamination with the exception of the west end. The west end of the P&O Gallery known as the White Room was at one time badly contaminated by plutonium nitrate solution.

These decontamination activities are not expected to result in an emissions increase over the levels of radionuclides released to the atmosphere during normal plant operations. The 1988 release of radionuclides from the P&O Gallery and White Room was $< 3.07 \times 10^{-6}$ Ci for alpha emitters and $< 1.42 \times 10^{-5}$ Ci for beta emitters (total of 1.73×10^{-5}) (Appendix line 467). The offsite dose from this activity is estimated to be 2.69×10^{-5} mrem (Table 3-9).

3.3.16 Deactivation of Support and Ancillary Systems

Since wet decontamination methods will be employed, no significant radiologic release to canyon air is anticipated. Past emission data for all of 1988 was available for only 293-A. This data did not indicate a radiological concern as the data was $< 2.42 \times 10^{-7}$ Ci for alpha emitters and $< 1.41 \times 10^{-6}$ Ci for beta emitters, which represents a sampling detection limit (total of 1.65×10^{-6} Ci) (Appendix line 468). Thus, the conservative offsite dose, assuming the detection limit zero value is real, is estimated to be 2.13×10^{-6} mrem (Table 3-9).

3.3.17 Utilities and Service Systems

This element of PUREX Plant deactivation involves the modification of utilities such as water, steam, electrical service and fire suppression system in order to put these systems in a low maintenance mode. For example, blanking the water main will reduce the probability of water intrusion into the facility in the case of a line failure. None of these activities involve any action that might mobilize or release radiological pollutants to the air.

3.3.18 Ventilation System Consolidation

The deep bed filters contain an unquantified inventory of residual radionuclides. However, the deep bed filters may be isolated as a part of deactivation. Also, some of the ducting involved in this activity is contaminated. The levels of contamination in the ducting have not been determined and cannot be quantified unless several penetrations are made at various duct locations.

Releases from the HVAC modification activities are not expected to be greater than releases from similar activities during facility operations (e.g., installation of the canyon exhaust fourth filter [HEPA], routine HEPA filter changes, decontamination of the canyon exhaust plenum and associated ducting, routine ventilation flow adjustments, main exhaust stack flushing, construction of the 292-AB Main Stack Sample Building and associated monitoring systems, maintenance and repair of fans, dampers and associated controls). Potential for resuspension of radionuclide inventory is reduced, as any supply and discharge pathways that are no longer needed will be blanked and sealed. The potential for resuspension of existing radionuclide inventory is further reduced since the final tie-ins and switching of the HVAC system will not occur until all canyon deactivation activities are complete. As a result, this activity should not result in radionuclide releases that would exceed those for similar activities conducted during past facility operations.

3.3.19 PUREX Laboratory Deactivation

The decontamination of the laboratory is not expected to result in an increase of radionuclides over the levels released to the atmosphere during normal plant operations. The 1988 release of radionuclides from the PUREX Laboratory was $< 8.87 \times 10^{-7}$ Ci for alpha emitters and $< 3.51 \times 10^{-6}$ Ci for beta emitters (total of 4.40×10^{-6} Ci).

The total deactivation activity source term is approximately 100 times less than what existed in 1988, during peak plant (section 3.2) and laboratory operation periods. 1988 PUREX laboratory emissions were < 8.87×10^{-7} Ci for alpha emitters and < 3.51×10^{-6} Ci for beta emitters (4.40×10^{-6} Ci total). The less than value indicates no measurable quantities were detected. However the less than values were assigned, to the sample results, to represent the uncertainty in the inherent constraints of the sampling and analysis techniques employed. Thus it is conservative to assign a less than value to the result of 'nothing measured' and this application conservatively estimates laboratory deactivation emissions to equal the 1988 PUREX Laboratory radionuclide emissions (Appendix line 469). Thus, the offsite dose is estimated to be 7.76×10^{-6} mrem (Table 3-9).

Table 3-9 Summary of Estimated PUREX Deactivation Radiological Releases
(Note: The factors to convert Ci to mrem are in the Appendix)

ITEM	SOURCE	ESTIMATED EMISSIONS (Ci)	ESTIMATED OFFSITE DOSE (mrem)
1	Contaminated Acid Disposition	1.07×10^{-9}	2.55×10^{-9}
2	Contaminated Solvent Disposal	1.87×10^{-10}	2.95×10^{-10}
3	Single Pass Reactor Fuel	1.47×10^{-8}	6.88×10^{-9}
4	Slug Basin Water	8.14×10^{-13}	1.96×10^{-14}
5	N-Reactor Fuel Assemblies	2.65×10^{-9}	3.05×10^{-10}
6	Chemical Disposition	0	0
7	Canyon Flushing	1.67×10^{-9}	1.33×10^{-10}
8	Concentrator (Items 4&7)	-	-
9	N Cell Cleanup	1.94×10^{-7}	1.85×10^{-6}
10	Metal Solution Disposition	1.41×10^{-10}	1.21×10^{-9}
11	Product Removal Room	1.83×10^{-8}	1.75×10^{-7}
12	Zirconium Heel Stabilization	2.65×10^{-8}	3.05×10^{-9}
13	Sample Gallery Ventilation	1.94×10^{-6}	4.56×10^{-6}
14	Q Cell Cleanup	7.05×10^{-13}	3.06×10^{-12}
15	P&O Gallery Ventilation	1.73×10^{-5}	2.69×10^{-5}
16	Support/Ancillary Ventilation (293-A)	1.65×10^{-6}	2.13×10^{-6}
17	Utilities/Service System	0	0
18	Ventilation System Consolidation	-	-
19	PUREX Laboratory	4.40×10^{-6}	7.76×10^{-6}
	N/Q/PR Ventilation (296-A-1) (Baseline of Items 9,11 & 14)	2.85×10^{-6}	1.57×10^{-5}
	Totals	**2.84×10^{-5}**	**5.91×10^{-5}**

4.0 SUMMARY

The deactivation activities have been reviewed for the potential for the release of radionuclides to the atmosphere. A summary of the estimated emissions and offsite dose associated with the deactivation of PUREX is presented below and compared to the limiting standard of 40 CFR 61 Subpart H (EPA 1990).

Approximately 60 percent of the estimated releases and 40 percent of the offsite dose obtained in this analysis are a result of emissions from the P&O Gallery (Table 3-9). These emissions are based on values reported as less than quantities ($<3.07 \times 10^{-6}$ Ci of alpha emitters and $<1.42 \times 10^{-5}$ Ci of beta). In addition, another 10 percent of the estimated releases and 26 percent of the offsite dose were attributed to the Product Removal Room Stack (296-A-1), which was based on 1.81×10^{-6} Ci of alpha emitters and $<1.04 \times 10^{-6}$ Ci of beta emitters. As a result, greater than 60 percent of the total estimated emissions and approximately 50 percent of the total projected offsite dose from this analysis is attributed to less than values from actual air emission data at the detection limit values and thus represent extremely conservative assumptions. The resulting offsite dose is negligible regardless.

Based on extremely conservative assumptions, this application indicates that approximately 2.84×10^{-5} Ci will be released to the atmosphere. The total worst case estimated offsite dose from PUREX deactivation is 5.91×10^{-5} mrem/yr. For a point of reference, the total emissions estimate from PUREX deactivation compared to a release from the operating PUREX facility in 1988, of 2.0×10^{5} Ci, is less than the operational value by a factor of approximately 1.1×10^{-10}.

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Appendix

APPENDIX

	A	B	C	D	E	F	G	H	I
1	EVALUATION OF RADIOACTIVE AIRBORNE RELEASES FROM PUREX TRANSITION WORK								
2									
3	NOTES:								
4	1. ADJUSTMENT FACTORS OBTAINED FROM 40 CFR 61, APPENDIX D								
5	2. SPECIFIC ACTIVITY VALUES OBTAINED FROM SD-RE-TI-131								
6	3. CAP88 DOSE FACTORS OBTAINED FROM WHC-EP-0498 USING A 10 METER STACK HEIGHT (MOST CONSERVATIVE)								
7									
8									
9	NOTES FOR ISOTOPES NOT LISTED IN WHC-EP-0498								
10		ISOTOPE DOSE							
11	DESIGNATOR	FACTOR USED							
12	* =	Sr-90							
13	** =	Pu-239							
14	*** =	Am-241							
15									
16									
17		CANYON FILTER							
18		EFFICIENCIES							
19	FIBERGLASS FILTER	99.90%							
20	HEPA FILTER	99.95%							
21	OVERALL FACTOR	2.500E-10							
22									
23	(FIBERGLASS AND TWO HEPA FILTER IN SERIES APPLIED TO OBTAIN TOTAL EMISSION OUT THE MAIN STACK COLUMN)								
24									
25									
26	RECOVERED NITRIC ACID						CONSERVATIVE		
27		TANK - P2	TANK - P3	TANK - U1	TANK - U2	SUB-TOTAL	ASSUMED TOTAL		
28	VOLUMES (GALLONS)	73,900	82,350	13,650	12,950	182,850	208,000		
29									
30	(USED "<" VALUES AS "=" VALUES)								
31			TANK - P2	TANK - P3	TANK - U1	TANK - U2			
32		SPECIFIC	COMPONENT	COMPONENT	COMPONENT	COMPONENT			
33		ACTIVITY	CONCENTRATION	CONCENTRATION	CONCENTRATION	CONCENTRATION			
34	COMPONENT	(Ci/g)	(g/l)	(g/l)	(g/l)	(g/l)			
35	Pu-239	6.20E-02	9.33E-08	1.34E-07	2.70E-08	1.77E-08			
36	U-238	3.36E-07	1.50E+01	1.04E+01	1.15E-04	1.21E-04			
37									
38		TANK - P2	TANK - P3	TANK - U1	TANK - U2				
39		COMPONENT	COMPONENT	COMPONENT	COMPONENT				
40		CONCENTRATION	CONCENTRATION	CONCENTRATION	CONCENTRATION				
41		(uCi/l)	(uCi/l)	(uCi/l)	(uCi/l)				
42	CePr-144	2.56E-01	2.09E-01	3.50E-01	6.50E-01				
43	Co-60	2.75E-02	4.26E-02	1.09E-02	4.08E-02				
44	Cs-134	2.81E-02	2.16E-02	4.70E-02	9.10E-02				
45	Cs-137	3.01E-02	4.25E-02	4.03E+00	9.02E+00				
46	Nb-95	2.78E-02	2.07E-02	9.25E-03	1.31E-02				
47	Ru-103	1.74E-02	1.41E-02	2.12E-02	5.20E-02				
48	RuRh-106	2.50E-01	3.11E-01	3.45E-01	7.78E-01				
49	Zr-95	3.63E-02	3.48E-02	1.37E-02	3.93E-02				
50	Th-228	1.58E+00	0.00E+00	1.22E-04	0.00E+00				
51	U-235	2.69E-01	1.98E-01	0.00E+00	0.00E+00				
52	Am-241	1.70E-05	1.70E-05	4.71E-05	4.41E-05				
53	Np-237	6.90E-05	6.08E-05	4.20E-05	2.08E-05				
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APPENDIX

	A	B	C	D	E	F	G	H	I
65	RECOVERED NITRIC ACID (CONTINUED)								
66			PARTICULATE	TOTAL ISOTOPE					
67		TOTAL ISOTOPE	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE			
68		CURIES IN	FACTOR	MAIN STACK	DOSE FACTOR	DOSE			
69		NITRIC ACID	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)			
70	Pu-239	2.07E-02	1.00E+00	5.19E-12	8.67E+00	4.50E-11			
71	U-238	2.84E+00	1.00E+00	7.09E-10	2.84E+00	2.01E-09			
72	CePr-144	2.12E-01	1.00E+00	5.31E-11	1.37E-02	7.27E-13			
73	Co-60	2.68E-02	1.00E+00	6.69E-12	2.90E-02	1.94E-13			
74	Cs-134	2.44E-02	1.00E+00	6.11E-12	3.13E-02	1.91E-13			
75	Cs-137	7.64E-01	1.00E+00	1.91E-10	2.39E-02	4.57E-12			
76	Nb-95	1.75E-02	1.00E+00	4.36E-12	1.76E-03	7.68E-15			
77	Ru-103	1.47E-02	1.00E+00	3.67E-12	1.42E-03	5.21E-15			
78	RuRh-106	2.53E-01	1.00E+00	6.34E-11	2.09E-02	1.32E-12			
79	Zr-95	2.69E-02	1.00E+00	6.72E-12	2.65E-03	1.78E-14			
80	Th-228	5.03E-01	1.00E+00	1.26E-10	5.69E+00	7.15E-10			
81	U-235	1.56E-01	1.00E+00	3.89E-11	2.96E+00	1.15E-10			
82	Am-241	1.67E-05	1.00E+00	4.17E-15	1.31E+01	5.46E-14			
83	Np-237	4.71E-05	1.00E+00	1.18E-14	1.19E+01	1.40E-13			
84									
85	TOTALS	4.80E+00		1.21E-09		2.90E-09			
86									
87									
88	SINGLE PASS REACTOR FUEL (ALUMINUM CLAD FUEL ASSEMBLIES)								
89									
90	QUANTITY	2.87	METRIC TONS						
91				PARTICULATE	TOTAL ISOTOPE				
92		SPECIFIC	TOTAL	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE		
93		ACTIVITY	ACTIVITY	FACTOR	MAIN STACK	DOSE FACTOR	DOSE		
94	COMPONENT	(Ci/Metric Ton)	(Ci)	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)		
95	Ni-63 - *	2.00E+01	5.74E+01	1.00E-03	1.43E-11	4.38E-02	6.29E-13		
96	Sr/Y-90	4.03E+03	1.16E+04	1.00E-03	2.89E-09	4.38E-02	1.27E-10		
97	Tc-99	2.00E+00	5.74E+00	1.00E-03	1.43E-12	1.09E-03	1.56E-15		
98	Cd-113-m - *	5.00E+00	1.44E+01	1.00E-03	3.59E-12	4.38E-02	1.57E-13		
99	Cs-134	2.00E+00	5.74E+00	1.00E-03	1.43E-12	3.13E-02	4.49E-14		
100	Cs-137	1.03E+04	2.96E+04	1.00E-03	7.40E-09	2.39E-02	1.77E-10		
101	Sm-151 - *	1.20E+02	3.44E+02	1.00E-03	8.61E-11	4.38E-02	3.77E-12		
102	Eu-154 - *	1.39E+02	3.99E+02	1.00E-03	9.97E-11	4.38E-02	4.37E-12		
103	Eu-155 - *	3.40E+01	9.76E+01	1.00E-03	2.44E-11	4.38E-02	1.07E-12		
104	Co-60	7.00E+01	2.01E+02	1.00E-03	5.02E-11	2.90E-02	1.46E-12		
105	U-234	3.70E-03	1.06E-02	1.00E-03	2.65E-15	3.19E+00	8.47E-15		
106	U-235	1.30E-03	3.73E-03	1.00E-03	9.33E-16	2.96E+00	2.76E-15		
107	U-236	2.70E-02	7.75E-02	1.00E-03	1.94E-14	3.02E+00	5.85E-14		
108	U-238	3.30E-01	9.47E-01	1.00E-03	2.37E-13	2.84E+00	6.72E-13		
109	Np-237	1.80E-02	5.17E-02	1.00E-03	1.29E-14	1.19E+01	1.54E-13		
110	Pu-238	4.30E-01	1.23E+00	1.00E-03	3.09E-13	8.02E+00	2.47E-12		
111	Pu-239	1.20E+02	3.44E+02	1.00E-03	8.61E-11	8.67E+00	7.46E-10		
112	Pu-240	1.90E+02	5.45E+02	1.00E-03	1.36E-10	8.66E+00	1.18E-09		
113	Pu-241	5.00E+03	1.44E+04	1.00E-03	3.59E-09	1.38E-01	4.95E-10		
114	Pu-242 - **	1.40E-01	4.02E-01	1.00E-03	1.00E-13	8.67E+02	8.71E-11		
115	Am-241 - ***	4.30E+02	1.23E+03	1.00E-03	3.09E-10	1.31E+01	4.04E-09		
116	Am-242m - ***	2.40E-01	6.89E-01	1.00E-03	1.72E-13	1.31E+01	2.26E-12		
117	Am-243 - ***	3.70E-01	1.06E+00	1.00E-03	2.65E-13	1.31E+01	3.48E-12		
118	Cm-242 - ***	2.00E-01	5.74E-01	1.00E-03	1.43E-13	1.31E+01	1.88E-12		
119									
120	TOTALS		5.88E+04		1.47E-08		6.88E-09		
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APPENDIX

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131	SLUG BASIN WATER								
132									
133	VOLUME =	53,000	GALLONS						
134	EVAPORATOR								
135	ADJUSTMENT FACTOR	1.00E-03							
136						PARTICULATE	TOTAL ISOTOPE		
137		SPECIFIC	COMPONENT	COMPONENT	TOTAL	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE
138		ACTIVITY	CONC	CONC.	ACTIVITY	FACTOR	MAIN STACK	DOSE FACTOR	DOSE
139	COMPONENT	(Ci/g)	(uCi/l)	(g/l)	(Ci)	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)
140	Cs-134		3.77E-02		7.56E-03	1.00E+00	1.89E-15	3.13E-02	5.92E-17
141	Cs-137		1.62E+01		3.25E+00	1.00E+00	8.12E-13	2.39E-02	1.94E-14
142	U-238	3.36E-07		2.71E-03	1.82E-04	1.00E+00	4.56E-17	2.84E+00	1.29E-16
143									
144	TOTALS				3.26E+00		8.14E-13		1.98E-14
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APPENDIX

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197	N-REACTOR FUEL ASSEMBLIES								
198									
199	Quantity =	0.3	MTU						
200				PARTICULATE	TOTAL ISOTOPE				
201			TOTAL	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE		
202		ACTIVITY	ACTIVITY	FACTOR	MAIN STACK	DOSE FACTOR	DOSE		
203	COMPONENT	(Ci/MTU)	(Ci)	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)		
204	Co-60	4.28E-01	1.28E-01	1.00E-03	3.21E-14	2.90E-02	9.30E-16		
205	Sr-89 - *	3.96E-06	1.19E-06	1.00E-03	2.97E-19	4.38E-02	1.30E-20		
206	Sr-90	6.22E+03	1.86E+03	1.00E-03	4.66E-10	4.38E-02	2.04E-11		
207	Ce-144	3.00E+03	9.00E+02	1.00E-03	2.25E-10	1.37E-02	3.08E-12		
208	Zr-95	1.18E-03	3.55E-04	1.00E-03	8.87E-17	2.65E-03	2.35E-19		
209	Nb-95	2.72E-03	8.17E-04	1.00E-03	2.04E-16	1.76E-03	3.59E-19		
210	Tc-99	1.21E+00	3.63E-01	1.00E-03	9.08E-14	1.09E-03	9.90E-17		
211	Ru-103	3.92E-09	1.18E-09	1.00E-03	2.94E-22	1.42E-03	4.18E-25		
212	Ru\Rh-106	1.60E+03	4.81E+02	1.00E-03	1.20E-10	2.09E-02	2.51E-12		
213	Cd-113m - *	2.94E+00	8.82E-01	1.00E-03	2.20E-13	4.38E-02	9.66E-15		
214	Sn-119m	1.92E-01	5.76E-02	1.00E-03	1.44E-14	8.63E-03	1.24E-16		
215	Sb-125	4.28E+02	1.28E+02	1.00E-03	3.21E-11	4.15E-03	1.33E-13		
216	Sn-126	6.35E-02	1.91E-02	1.00E-03	4.76E-15	8.63E-03	4.11E-17		
217	Te-127m - *	2.72E-02	8.17E-03	1.00E-03	2.04E-15	4.38E-02	8.95E-17		
218	Te-129m - *	5.63E-13	1.69E-13	1.00E-03	4.22E-26	4.38E-02	1.85E-27		
219	Ce-134	6.54E+02	1.96E+02	1.00E-03	4.90E-11	3.13E-02	1.54E-12		
220	Ce-135	3.26E-02	9.77E-03	1.00E-03	2.44E-15	2.15E-03	5.25E-18		
221	Ce-137	7.87E+03	2.36E+03	1.00E-03	5.91E-10	2.39E-02	1.41E-11		
222	Ce-141	2.14E-02	6.43E-03	1.00E-03	1.61E-15	1.37E-02	2.20E-17		
223	Ce-144	2.30E+03	6.89E+02	1.00E-03	1.72E-10	1.37E-02	2.36E-12		
224	Pm-147	7.06E+03	2.12E+03	1.00E-03	5.29E-10	1.14E-03	6.03E-13		
225	Pm-148 - *	1.56E-11	4.67E-12	1.00E-03	1.17E-24	4.38E-02	5.11E-26		
226	Pm-148m - *	2.76E-10	8.28E-11	1.00E-03	2.07E-23	4.38E-02	9.07E-25		
227	Sm-151 - *	9.08E+01	2.73E+01	1.00E-03	6.81E-12	4.38E-02	2.98E-13		
228	Eu-152 - *	8.17E-01	2.45E-01	1.00E-03	6.12E-14	4.38E-02	2.68E-15		
229	Gd-153 - *	6.62E-03	1.99E-03	1.00E-03	4.96E-16	4.38E-02	2.17E-17		
230	Eu-154 - *	1.27E+02	3.81E+01	1.00E-03	9.52E-12	4.38E-02	4.17E-13		
231	Eu-155 - *	6.88E+01	2.06E+01	1.00E-03	5.16E-12	4.38E-02	2.26E-13		
232	Tb-160 - *	5.15E-07	1.54E-07	1.00E-03	3.86E-20	4.38E-02	1.69E-21		
233	Hd-166m - *	1.45E-05	4.35E-06	1.00E-03	1.09E-18	4.38E-02	4.76E-20		
234	U-232 - **	1.68E-04	5.04E-05	1.00E-03	1.26E-17	8.67E+00	1.09E-16		
235	U-233	1.90E-06	5.71E-07	1.00E-03	1.43E-19	3.23E+00	4.61E-19		
236	U-234	4.07E-01	1.22E-01	1.00E-03	3.05E-14	3.19E+00	9.73E-14		
237	U-235	1.52E-02	4.56E-03	1.00E-03	1.14E-15	2.96E+00	3.38E-15		
238	U-236	5.27E-02	1.58E-02	1.00E-03	3.95E-15	3.02E+00	1.19E-14		
239	U-237 - **	1.38E-01	4.15E-02	1.00E-03	1.04E-14	8.67E+00	8.99E-14		
240	U-238	3.32E-01	9.96E-02	1.00E-03	2.49E-14	2.84E+00	7.07E-14		
241	Np-237	2.77E-02	8.30E-03	1.00E-03	2.08E-15	1.19E+01	2.47E-14		
242	Pu-236 - *	7.50E-04	2.25E-04	1.00E-03	5.63E-17	8.67E+00	4.88E-16		
243	Pu-237 - *	1.26E-14	3.78E-15	1.00E-03	9.45E-28	8.67E+00	8.19E-27		
244	Pu-238	5.02E+01	1.50E+01	1.00E-03	3.76E-12	8.02E+00	3.02E-11		
245	Pu-239	1.10E+02	3.30E+01	1.00E-03	8.25E-12	8.67E+00	7.15E-11		
246	Pu-240	6.78E+01	2.03E+01	1.00E-03	5.08E-12	8.66E+00	4.40E-11		
247	Pu-241	5.64E+03	1.69E+03	1.00E-03	4.23E-10	1.38E-01	5.83E-11		
248	Pu-242 - *	2.03E-02	6.09E-03	1.00E-03	1.52E-15	8.67E+00	1.32E-14		
249	Pu-243 - *	1.58E-12	4.73E-13	1.00E-03	1.18E-25	8.67E+00	1.02E-24		
250	Am-241	5.30E+01	1.59E+01	1.00E-03	3.98E-12	1.31E+01	5.21E-11		
251	Am-242m - ***	1.10E-01	3.31E-02	1.00E-03	8.28E-15	1.31E+01	1.08E-13		
252	Am-242 - ***	1.10E-01	3.29E-02	1.00E-03	8.23E-15	1.31E+01	1.08E-13		
253	Cm-244	5.50E+00	1.65E+00	1.00E-03	4.12E-13	6.94E+00	2.86E-12		
254									
255	TOTALS		1.08E+04		2.65E-09		3.05E-10		
256									
257									
258									
259									
260									
261									
262									

APPENDIX

	A	B	C	D	E	F	G	H	I
263	CANYON FLUSHING								
264									
265	VOLUME =	846,000	GALLONS						
266	EVAPORATOR								
267	ADJUSTMENT FACTOR	1.00E-03							
268						NET PARTICLE	TOTAL ISOTOPE		
269		SPECIFIC	COMPONENT	COMPONENT	TOTAL	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE
270		ACTIVITY	CONC	CONC	ACTIVITY	FACTOR	MAIN STACK	DOSE FACTOR	DOSE
271	COMPONENT	(Ci/g)	(uCi/l)	(g/l)	(Ci)	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)
272	CePr-144		9.43E+02		2.31E+03	1.00E-03	5.78E-10	1.37E-02	7.90E-12
273	Co-60		3.09E+00		7.56E+00	1.00E-03	1.89E-12	2.90E-02	5.48E-14
274	Cs-134		1.05E+01		2.57E+01	1.00E-03	6.42E-12	3.13E-02	2.01E-13
275	Cs-137		7.35E+02		1.80E+03	1.00E-03	4.49E-10	2.39E-02	1.07E-11
276	Am-241		8.23E+00		2.01E+01	1.00E-03	5.03E-12	1.31E+01	6.59E-11
277	Sb-125		1.46E+02		3.57E+02	1.00E-03	8.92E-11	4.15E-03	3.70E-13
278	RuRh-106		8.72E+02		2.13E+03	1.00E-03	5.33E-10	2.09E-02	1.11E-11
279	U-238	3.36E-07		6.32E+01	5.19E+01	1.00E-03	1.30E-11	2.84E+00	3.69E-11
280									
281	TOTALS				6.70E+03		1.67E-09		1.33E-10
282									
283									
284	METAL SOLUTION DISPOSITION								
285									
286	*TANK D5*								
287	VOLUME =	10,900	LITERS						
288						PARTICULATE	TOTAL ISOTOPE		
289		SPECIFIC	COMPONENT	COMPONENT	TOTAL	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE
290		ACTIVITY	CONC	CONC.	ACTIVITY	FACTOR	MAIN STACK	DOSE FACTOR	DOSE
291	COMPONENT	(Ci/g)	(uCi/l)	(g/l)	(Ci)	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)
292	Am-241		3.77E-02		4.11E-04	1.00E-03	1.03E-10	1.31E+01	1.35E-15
293	Cs-134		6.20E+00		6.76E-02	1.00E-03	1.69E-14	3.13E-02	5.29E-16
294	Cs-137		1.62E+01		1.77E-01	1.00E-03	4.41E-14	2.39E-02	1.06E-15
295	CePr-144		3.47E+01		3.78E-01	1.00E-03	9.46E-14	1.37E-02	1.30E-15
296	RuRh-106		4.18E+01		4.56E-01	1.00E-03	1.14E-13	2.09E-02	2.38E-15
297	Sb-125		1.29E+02		1.41E+00	1.00E-03	3.52E-13	4.15E-03	1.46E-15
298	U-235		4.20E+00		4.58E-02	1.00E-03	1.14E-14	2.98E+00	3.39E-14
299	U-238	3.36E-07		2.66E+02	9.74E-01	1.00E-03	2.44E-13	2.84E+00	6.92E-13
300	Pu-239	6.20E-02		3.67E-01	2.48E+02	1.00E-03	6.20E-11	8.67E+00	5.38E-10
301									
302	D5 TOTALS				2.52E+02		6.29E-11		5.38E-10
303									
304	*TANK E6*								
305	VOLUME =	8,900	LITERS						
306						PARTICULATE	TOTAL ISOTOPE		
307		SPECIFIC	COMPONENT	COMPONENT	TOTAL	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE
308		ACTIVITY	CONC	CONC.	ACTIVITY	FACTOR	MAIN STACK	DOSE FACTOR	DOSE
309	COMPONENT	(Ci/g)	(uCi/l)	(g/l)	(Ci)	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)
310	Am-241		3.77E-02		3.36E-04	1.00E-03	8.39E-17	1.31E+01	1.10E-15
311	Cs-134		6.20E+00		5.52E-02	1.00E-03	1.38E-14	3.13E-02	4.32E-16
312	Cs-137		1.62E+01		1.44E-01	1.00E-03	3.60E-14	2.39E-02	8.61E-16
313	CePr-144		3.47E+01		3.09E-01	1.00E-03	7.72E-14	1.37E-02	1.06E-15
314	RuRh-106		4.18E+01		3.72E-01	1.00E-03	9.30E-14	2.09E-02	1.94E-15
315	Sb-125		1.29E+02		1.15E+00	1.00E-03	2.87E-13	4.15E-03	1.19E-15
316	U-235		4.20E+00		3.74E-02	1.00E-03	9.34E-15	2.98E+00	2.77E-14
317	U-238	3.36E-07		2.70E+02	8.08E-01	1.00E-03	2.02E-13	2.84E+00	5.73E-13
318	Pu-239	6.20E-02		5.62E-01	3.10E+02	1.00E-03	7.75E-11	8.67E+00	6.72E-10
319									
320	E6 TOTALS				3.13E+02		7.82E-11		6.73E-10
321									
322	D5 + E6 TOTALS				5.64E+02		1.41E-10		1.21E-09
323									
324									
325									
326									
327									

APPENDIX

	A	B	C	D	E	F	G	H	I
328	ZIRCONIUM HEEL STABILIZATION								
329									
330	Quantity =	3.0	MTU						
331									
332				PARTICULATE	TOTAL ISOTOPE				
333			TOTAL	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE		
334		ACTIVITY	ACTIVITY	FACTOR	MAIN STACK	DOSE FACTOR	DOSE		
335	COMPONENT	(Ci/MTU)	(Ci)	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)		
336	Co-60	4.28E-01	1.28E+00	1.00E-03	3.21E-13	2.90E-02	9.30E-15		
337	Sr-89 - *	3.90E-06	1.19E-05	1.00E-03	2.97E-18	4.38E-02	1.30E-19		
338	Sr-90	6.22E+03	1.86E+04	1.00E-03	4.66E-09	4.38E-02	2.04E-10		
339	Ce-144	3.00E+03	9.00E+03	1.00E-03	2.25E-09	1.37E-02	3.08E-11		
340	Zr-95	1.18E-03	3.55E-03	1.00E-03	8.87E-16	2.65E-03	2.35E-18		
341	Nb-95	2.72E-03	8.17E-03	1.00E-03	2.04E-15	1.76E-03	3.59E-18		
342	Tc-99	1.21E+00	3.63E+00	1.00E-03	9.08E-13	1.09E-03	9.90E-16 *		
343	Ru-103	3.92E-09	1.18E-08	1.00E-03	2.94E-21	1.42E-03	4.18E-24		
344	Ru\Rh-106	1.60E+03	4.81E+03	1.00E-03	1.20E-09	2.09E-02	2.51E-11		
345	Cd-113m - *	2.94E+00	8.82E+00	1.00E-03	2.20E-12	4.38E-02	9.66E-14		
346	Sn-119m	1.92E-01	5.76E-01	1.00E-03	1.44E-13	8.63E-03	1.24E-15		
347	Sb-125	4.28E+02	1.28E+03	1.00E-03	3.21E-10	4.15E-03	1.33E-12		
348	Sn-126	6.35E-02	1.91E-01	1.00E-03	4.76E-14	8.63E-03	4.11E-16		
349	Te-127m - *	2.72E-02	8.17E-02	1.00E-03	2.04E-14	4.38E-02	8.95E-16		
350	Te-129m - *	5.63E-13	1.69E-12	1.00E-03	4.22E-25	4.38E-02	1.85E-26		
351	Cs-134	6.54E+02	1.96E+03	1.00E-03	4.90E-10	3.13E-02	1.54E-11		
352	Cs-135	3.26E-02	9.77E-02	1.00E-03	2.44E-14	2.15E-03	5.25E-17		
353	Cs-137	7.87E+03	2.36E+04	1.00E-03	5.91E-09	2.39E-02	1.41E-10		
354	Ce-141	2.14E-02	6.43E-02	1.00E-03	1.61E-14	1.37E-02	2.20E-16		
355	Ce-144	2.30E+03	6.89E+03	1.00E-03	1.72E-09	1.37E-02	2.36E-11		
356	Pm-147	7.06E+03	2.12E+04	1.00E-03	5.29E-09	1.14E-03	6.03E-12		
357	Pm-148 - *	1.56E-11	4.67E-11	1.00E-03	1.17E-23	4.38E-02	5.11E-25		
358	Pm-148m - *	2.76E-10	8.28E-10	1.00E-03	2.07E-22	4.38E-02	9.07E-24		
359	Sm-151 - *	9.08E+01	2.73E+02	1.00E-03	6.81E-11	4.38E-02	2.98E-12		
360	Eu-152 - *	8.17E-01	2.45E+00	1.00E-03	6.12E-13	4.38E-02	2.68E-14		
361	Gd-153 - *	6.62E-03	1.99E-02	1.00E-03	4.96E-15	4.38E-02	2.17E-16		
362	Eu-154 - *	1.27E+02	3.81E+02	1.00E-03	9.52E-11	4.38E-02	4.17E-12		
363	Eu-155 - *	6.88E+01	2.06E+02	1.00E-03	5.16E-11	4.38E-02	2.26E-12		
364	Tb-160 - *	5.15E-07	1.54E-06	1.00E-03	3.86E-19	4.38E-02	1.69E-20		
365	Nd-166m - *	1.45E-05	4.35E-05	1.00E-03	1.09E-17	4.38E-02	4.76E-19		
366	U-232 - **	1.68E-04	5.04E-04	1.00E-03	1.26E-16	8.67E+00	1.09E-15		
367	U-233	1.90E-06	5.71E-06	1.00E-03	1.43E-18	3.23E+00	4.61E-18		
368	U-234	4.07E-01	1.22E+00	1.00E-03	3.05E-13	3.19E+00	9.73E-13		
369	U-235	1.52E-02	4.56E-02	1.00E-03	1.14E-14	2.98E+00	3.38E-14		
370	U-236	5.27E-02	1.58E-01	1.00E-03	3.95E-14	3.02E+00	1.19E-13		
371	U-237 - **	1.38E-01	4.15E-01	1.00E-03	1.04E-13	8.67E+00	8.99E-13		
372	U-238	3.32E-01	9.96E-01	1.00E-03	2.49E-13	2.84E+00	7.07E-13		
373	Np-237	2.77E-02	8.30E-02	1.00E-03	2.08E-14	1.19E+01	2.47E-13		
374	Pu-236 - *	7.50E-04	2.25E-03	1.00E-03	5.63E-16	8.67E+00	4.88E-15		
375	Pu-237 - *	1.26E-14	3.78E-14	1.00E-03	9.45E-27	8.67E+00	8.19E-26		
376	Pu-238	5.02E+01	1.50E+02	1.00E-03	3.76E-11	8.02E+00	3.02E-10		
377	Pu-239	1.10E+02	3.30E+02	1.00E-03	8.25E-11	8.67E+00	7.15E-10		
378	Pu-240	6.78E+01	2.03E+02	1.00E-03	5.08E-11	8.66E+00	4.40E-10		
379	Pu-241	5.64E+03	1.69E+04	1.00E-03	4.23E-09	1.38E-01	5.83E-10		
380	Pu-242 - *	2.03E-02	6.09E-02	1.00E-03	1.52E-14	8.67E+00	1.32E-13		
381	Pu-243 - *	1.58E-12	4.73E-12	1.00E-03	1.18E-24	8.67E+00	1.02E-23		
382	Am-241	5.30E+01	1.59E+02	1.00E-03	3.98E-11	1.31E+01	5.21E-10		
383	Am-242m - ***	1.10E-01	3.31E-01	1.00E-03	8.28E-14	1.31E+01	1.08E-12		
384	Am-242 - ***	1.10E-01	3.29E-01	1.00E-03	8.23E-14	1.31E+01	1.08E-12		
385	Cm-244	5.50E+00	1.65E+01	1.00E-03	4.12E-12	6.94E+00	2.86E-11		
386									
387	TOTALS		1.06E+05		2.65E-08		3.05E-09		
388									
389									
390									
391									
392									
393									

APPENDIX

	A	B	C	D	E	F	G	H	I
394	SUMMARY OF ACTIVITES - MAIN STACK								
395									
396	TOTAL ACTIVITY	1.83E+05	CURIES						
397	EMISSIONS RELEASED	4.69E-08	CURIES						
398	OFF-SITE DOSE	1.45E-08	mrem						
399									
400									
401									
402	CONTAMINATED SOLVENT DISPOSAL								
403									
404		TOTAL	ISOTOPE OFFSITE	ISOTOPE OFFSITE					
405		CURIES	DOSE FACTOR	DOSE					
406		RELEASED	(mrem/Ci)	(mrem)					
407	Pu-239	3.32E-11	8.67E+00	2.88E-10					
408	Sr-90	1.54E-10	4.38E-02	6.75E-12					
409									
410	TOTALS	1.87E-10		2.95E-10					
411	(NO FILTRATION)								
412									
413									
414	N-CELL CLEANUP								
415	HEPA Filter Efficiency	99.95%							
416	ADJUSTMENT FACTOR	2.50E-07							
417					PARTICULATE	TOTAL ISOTOPE			
418		SPECIFIC	COMPONENT	TOTAL	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE	
419		ACTIVITY	WEIGHT	ACTIVITY	FACTOR	P.R. STACK	DOSE FACTOR	DOSE	
420		(Ci/g)	(g)	(Ci)	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)	
421	Pu-239	6.20E-02	1.00E+04	6.20E+02	1.00E-03	1.55E-07	8.67E+00	1.34E-06	
422	Am-241	3.43E+00	4.50E+01	1.54E+02	1.00E-03	3.86E-08	1.31E+01	5.05E-07	
423									
424	TOTALS			6.20E+02		1.94E-07		1.85E-06	
425									
426									
427	PRODUCT REMOVAL ROOM DEACTIVATION								
428	HEPA Filter Efficiency	99.95%							
429	ADJUSTMENT FACTOR	2.50E-07							
430					PARTICULATE	TOTAL ISOTOPE			
431		SPECIFIC	COMPONENT	TOTAL	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE	
432		ACTIVITY	WEIGHT	ACTIVITY	FACTOR	P.R. STACK	DOSE FACTOR	DOSE	
433		(Ci/g)	(g)	(Ci)	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)	
434	Pu-239	6.20E-02	9.46E+02	5.87E+01	1.00E-03	1.47E-08	8.67E+00	1.27E-07	
435	Am-241	3.43E+00	4.20E+00	1.44E+01	1.00E-03	3.65E-09	1.31E+01	4.78E-08	
436									
437	TOTALS			7.33E+01		1.83E-08		1.75E-07	
438									
439									
440	Q-CELL CLEANUP								
441	HEPA Filter Efficiency	99.95%							
442	ADJUSTMENT FACTOR	2.50E-07							
443					PARTICULATE	TOTAL ISOTOPE			
444		SPECIFIC	COMPONENT	TOTAL	ADJUSTMENT	EMISSIONS OUT	ISOTOPE OFFSITE	ISOTOPE OFFSITE	
445		ACTIVITY	WEIGHT	ACTIVITY	FACTOR	P.R. STACK	DOSE FACTOR	DOSE	
446		(Ci/g)	(g)	(Ci)	(40 CFR 61)	(Ci)	(mrem/Ci)	(mrem)	
447	Np-237	7.05E-04	2.00E+00	1.41E-03	1.00E-03	3.52E-13	8.67E+00	3.06E-12	
448	Pa-233	7.05E-04	2.00E+00	1.41E-03	1.00E-03	3.52E-13	0.00E+00	0.00E+00	
449									
450	TOTALS			2.82E-03		7.05E-13		3.06E-12	
451									
452									
453									
454									
455									
456									
457									
458									
459									

APPENDIX

	A	B	C	D	E	F	G	H	I
460	ADDITIONAL STACK EMISSIONS								
461	(USED "<" VALUES AS "=" VALUES)								
462		TOTAL ALPHA	TOTAL BETA		INDIVIDUAL DOSE	INDIVIDUAL DOSE	INDIVIDUAL TOTAL		
463		ASSUME Pu-239	ASSUME Ru-106	TOTAL	ALPHA	BETA	DOSE		
464	VENTILATION SOURCE	(CURIES)	(CURIES)	(CURIES)	(mrem)	(mrem)	(mrem)		
465	N-/O-CELL & PR ROOM	1.81E-08	1.04E-06	2.85E-06	1.57E-05	2.17E-08	1.57E-05		
466	SAMPLE GALLERY	5.22E-07	1.42E-06	1.94E-06	4.53E-06	2.97E-08	4.56E-06		
467	P&O GALLERY	3.07E-06	1.42E-05	1.73E-05	2.66E-05	2.97E-07	2.69E-05		
468	293-A	2.42E-07	1.41E-06	1.65E-06	2.10E-06	2.95E-08	2.13E-06		
469	PUREX LABORATORY	8.87E-07	3.51E-06	4.40E-06	7.69E-06	7.34E-08	7.76E-06		
470									
471	TOTALS	6.53E-06	2.16E-05						
472	DOSE FACTOR (mrem/Ci)	8.67E+00	2.09E-02						
473	OFFFSITE DOSE (mrem)	5.66E-05	4.52E-07						
474									
475									
476									
477	SUMMARY								
478	TOTAL CURIES	1.83E+05	CURIES						
479	TOTAL EMISSIONS	2.84E-05	CURIES						
480	TOTAL OFFSITE DOSE	5.91E-05	mrem						

CORRESPONDENCE DISTRIBUTION COVERSHEET

Author	Addressee	Correspondence No.
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Subject: APPLICATION FOR APPROVAL OF MODIFICATION FOR PLUTONIUM-URANIUM EXTRACTION DEACTIVATION

INTERNAL DISTRIBUTION

Approval	Date	Name	Location	w/att
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		R. C. Bowman	H6-24	
		W. T. Dixon, Assignee	H6-21	
		R. H. Engelmann	H6-26	
		D. G. Hamrick	S6-15	
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		G. W. Jackson	H6-21	
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		GLL/File/LB	H6-25	